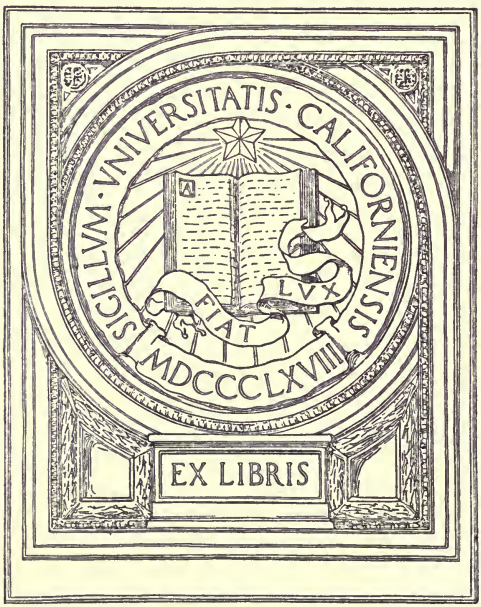
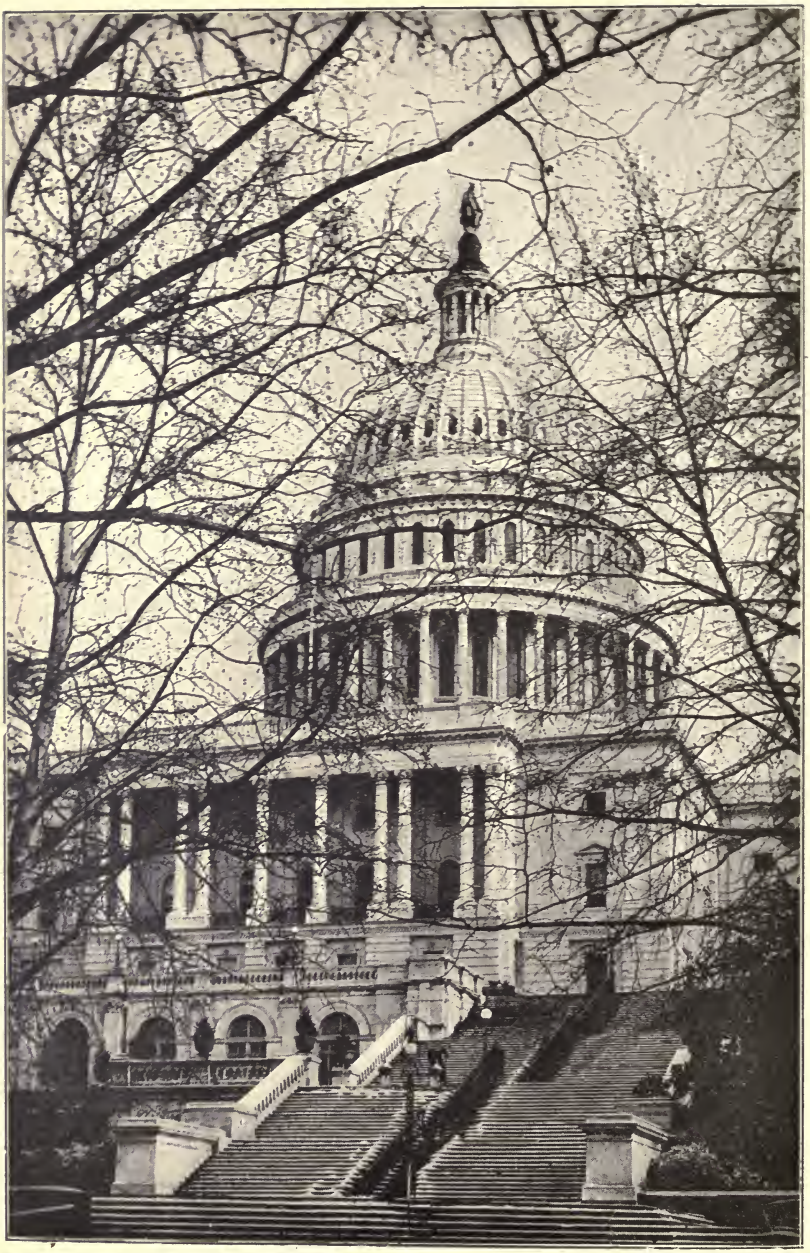
OUR COUNTRY AND ITS RESOURCES

SCIENTIFIC AMERICAN SERIES



Thomas R Thomson
Jan 1920



"THE HEART OF THE NATION"

OUR COUNTRY

AND

ITS RESOURCES

WHAT WE OUGHT TO KNOW ABOUT AGRICULTURE—FISHERIES
FORESTS—PANAMA CANAL—RAILROADS—MANUFACTURES
AUTOMOBILES – INDUSTRIAL PREPAREDNESS – THE
NEW NAVY—THE ARMY—OUR MONEY—AERO-
NAUTICS—MOTION PICTURES—THE
WEATHER - ASTRONOMY – THE
NATION'S CAPITAL—THE
PRESIDENT - CONGRESS
ALL ABOUT THE
GOVERNMENT

BY
ALBERT A. HOPKINS, 1869-
Member of the American Statistical Association
Editor of the Scientific American Reference Book
Scientific American Cyclopedia of Formulas, etc.

With 800 Illustrations

SCIENTIFIC AMERICAN SERIES

NEW YORK
MUNN & CO., INC.
SCIENTIFIC AMERICAN OFFICE
1917

PREFACE

THE "Wave of Prosperity" which has raised our country to an unparalleled position need not ever recede if we take measure of our resources and their development at the present time and act wisely upon the information obtained. It is the object of this modest volume to present such facts as can be obtained from official sources, in a readable and withal likable form, so that we may have a more wholesome respect for what Uncle Sam is doing for us. The "Stars and Stripes" are protected by Acts of Congress and State laws; the American Eagle cannot be kept in captivity (except in a zoological garden), but the power of the law has never been invoked to protect that symbol of our Federal Government—"Uncle Sam." This kindly old gentleman with his fuzzy beaver hat, his striped trousers and his parti-colored coat of the period of 1830, is used dozens of times daily in cartoons, but always in a respectful sense as we use it here—as a symbol of national esteem.

There is no more fascinating story in the world than how we are governed by means of often invisible threads that seem to begin nowhere, but always end somewhere to our profit and often pleasure. Who shall tell this wonderful story of achievement? How five blades of grass are made to grow where two should be found; how fish that have been left high and dry on land after a flood are put back in water to prevent "air drowning;" how forests are conserved at a profit; how reclamation makes the desert smile; how national parks can be run for both profit and pleasure; how good roads decrease the cost of living; how the three great Government Surveys carry on their ceaseless work to exploit our resources, or chart the fairways of commerce; how the Coast Guard is always on the lookout to protect life and property at sea; how the Patent Office has succeeded in making us a nation of

inventors and quadrupling our national wealth; how commercial and industrial preparedness have changed the gears on the car of industrial progress—all these and many more remain to be told. Who shall tell the story? Why not "let Uncle Sam do it"? He is patient, kind, amiable, and exceedingly accurate in his information.

This is what has been done here. Uncle Sam tells his complex story in his own way with the pen of high Government officials—cabinet officers, heads of the great governmental manufacturing plants and bureaus under Government auspices, down the list until all of the Government activities are accounted for. Unfortunately, the names cannot always be published, owing to departmental regulations, but enough names have been printed throughout the book to stamp this as a very authentic, and make it practically a semi-official guide to Government activities. In the section known as "Uncle Sam's Autobiography" every chapter has been submitted to either the Secretary of the Department, or to some responsible officer for revision. This has required an almost endless correspondence, but the Editor has the satisfaction of knowing that the information is as nearly right as it is possible to get it.

Besides Government officials, named and unnamed, special thanks are due to Mr. C. F. Talman, Librarian of the U. S. Weather Bureau; Dr. F. L. Hoffman, Statistician of the Prudential Insurance Company; Dr. Richard Rathbun of the Smithsonian Institution; Mr. Louis Annin Ames, an authority on flags, and a number of others who have given their kind assistance. Adequate pictorial treatment heightens the interest of this fascinating subject, and the whole country has been canvassed for interesting pictures; thus, for the chapter on Agriculture, over 35,000 photographs were examined to select the significant ones.

It is hoped that this book will be a real contribution to literature on true preparedness—preparedness for the arts of peace, as well as the arts of war.

TABLE OF CONTENTS

Part One

UNCLE SAM'S ACTIVITIES AND INTERESTS

CHAPTER		PAGE
I	Geographical Discovery	1
II.	Population	19
III.	Agriculture	37
IV.	The Fish We Eat	67
V.	Forests and Forestry	75
VI.	Reclamation Service	87
VII.	Our National Parks	95
VIII.	Good Roads and Bad	103
IX.	The Panama Canal	109
X.	The Three Great Government Surveys	119
XI.	Government Protection of Life and Property at Sea	135
XII.	Railroads of the United States	147
XIII.	The Postal Service	161
XIV.	Our Natural Resources and How They are Developed	173
XV.	The Mineral Industry of the United States	177
XVI.	The Patent Office and Inventions Since 1845	199
XVII.	Manufactures	211
XVIII.	The Automobile Industry	223
XIX.	The Recent Development of American Commerce	231
XX.	Commercial and Industrial Preparedness	245
XXI.	Education	255
XXII.	The New Navy	263
XXIII.	The Army	281
XXIV.	Uncle Sam's Money	
	Part I. The Treasury	293
	Part II. Bureau of Engraving and Printing	299
	Part III. The Assay Office	309
	Part IV. How Coins are Minted	313

CHAPTER PAGE
XXV. How Uncle Sam Protects His Revenue : : : 321
XXVI. Uncle Sam's Non-Contiguous Possessions : : : 327

Part Two

OF HUMAN INTEREST TO ALL UNCLE SAM'S PEOPLE

I. The American Flag : : : : : : 347
II. Aeronautics : : : : : : : : 363
III. Wireless Telegraphy and Telephony : : : 383
IV. Motion Pictures in the Making : : : : 399
V. The Realm of the Air : : : : : : 411
VI. The Heavens Above : : : : : : 423

Part Three

UNCLE SAM'S AUTOBIOGRAPHY

I. Washington—The Nation's City : : : : 447
II. The Legislative Hal's : : : : : : 455
III. The President—The Executive : : : : 465
IV. The Cabinet : : : : : : : : 477
V. Department of State : : : : : : 479
VI. Department of the Treasury : : : : : 493
VII. Department of War : : : : : : 507
VIII. Department of Justice : : : : : : 521
IX. Post Office Department : : : : : : 525
X. Department of the Navy : : : : : : 526
XI. Department of the Interior : : : : : 539
XII. Department of Agriculture : : : : : 547
XIII. Department of Commerce : : : : : 561
XIV. Department of Labor : : : : : : 572
XV. The Smithsonian Institution : : : : : 575
XVI. Miscellaneous Activities of the Government : : 582
XVII. Pan American Union : : : : : : 591

WHAT UNCLE SAM'S "O. K." LOOKS LIKE.

Copyright by United Newspapers, London; Underwood & Underwood, N. Y.

ONE OF THE MEMBERS OF THE AMUNDSEN SOUTH POLE EXPEDITION STANDING AT THE POLE

Taken by Captain Amundsen Himself

Copyright by Underwood & Underwood

CAPT. ROALD AMUNDSEN, WHO DISCOVERED THE SOUTH POLE ON DECEMBER 14, 1911.

Copyright by Underwood & Underwood

CAPT. SCOTT, WHO ALSO FOUND THE SOUTH POLE AFTER AMUNDSEN, ON JANUARY 18, 1912, AND PERISHED.

Part I.

UNCLE SAM'S ACTIVITIES AND INTERESTS

CHAPTER I.

PROGRESS OF GEOGRAPHICAL DISCOVERY

By CYRUS C. ADAMS

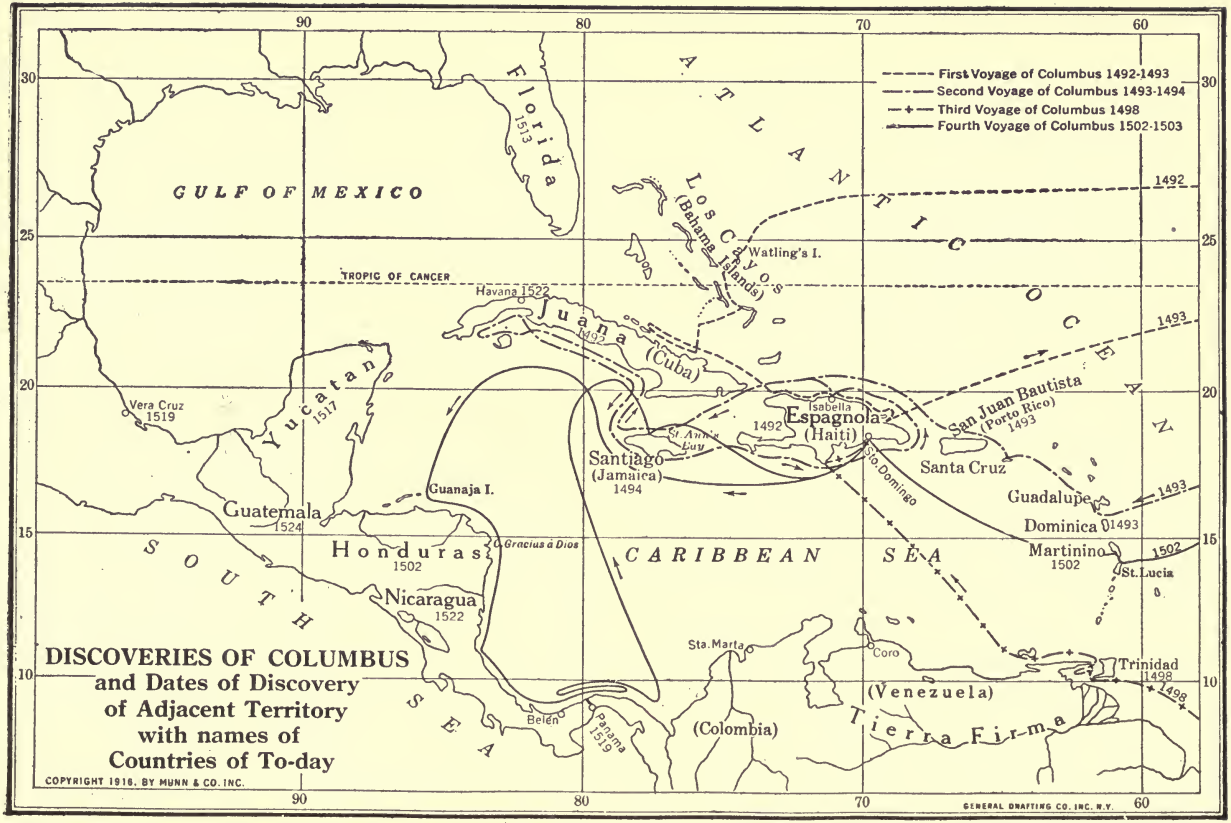
THE greatest era of geographical discovery dawned when Christopher Columbus, with three small vessels, carrying 88 men, sailed into the Unknown from Palos, Spain, on August 3, 1492. The significance of this voyage was not only that it brought to light the Western World, but that it also disclosed the sea as the great highway of men by which they soon learned to reach all the vast islands (continents) and the lesser islands of the globe. Europe, for example, had a very misty idea of China and India till sea routes placed her in touch with them. Sea routes hugged the coasts of Europe and Africa for thousands of miles; but Columbus added cross sea sailing to the coast routes and thus brought in the day of worldwide exploration.

The Vikings of Norway in the ninth-tenth centuries A. D. had discovered Iceland, Greenland and the northeast coast of North America; but these daring sea rovers were far from European centers; and as it was thought that Greenland was a part of Europe, their work was not at all appreciated, and, in fact, was very little known.

Columbus's four voyages, 1492-1503, brought to light the larger and many of the smaller islands of the West Indies. He saw South America from the island of Trinidad and noted the freshness of the Gulf of Paria's waters which come from the Orinoco. He skirted the eastern shores of Central America from Guanaja Island, around Cape Gracias á Dios, paused at Belén on the Isthmus of Panama, thence on to Puerto Bello, the most southern point he reached. His field of discovery embraced the area between about 9 to 24 degrees North Latitude and 60 to 87 degrees West Longitude. At St. Ann's Bay, on the north coast of Jamaica, he ended his great work about thirteen years after he began it.

Immediate effects of his achievement were apparent. Ten days less than a year after Columbus started on his third voyage to America, Vasco da Gama, after rounding the Cape of Good Hope, landed at Calicut, the first European navigator to reach India. This was the beginning of the great sea-trade between Europe and the East Indies.

Thirteen years and 3 months after Columbus died, Magellan started on his journey around the world (1519-


First Voyage of Columbus 1492-1493
Second Voyage of Columbus 1493-1494
Third Voyage of Columbus 1498
Fourth Voyage of Columbus 1502-1503
GULF OF MEXICO
ATLANTIC OCEAN
CARIBBEAN SEA
SOUTH SEA
Florida 1513
Los Cayos (Bahama Islands)
Watling's I.
1492
TROPIC OF CANCER
Havana 1522
Juana (Cuba)
1493
1493
Vera Cruz 1519
Yucatan 1517
Isabella 1492
Espagnola (Haiti)
San Juan Bautista (Porto Rico) 1493
St. Anne's Bay
Santiago (Jamaica) 1494
Santa Cruz
Guadalupe 1493
Dominica 1493
Guanaja I.
Guatemala 1524
Honduras 1502
C. Gracius à Dios
Martinino 1502
St. Lucia
Nicaragua 1522
Sta. Marta
Coro
Trinidad 1498
(Venezuela)
Tierra Firma
Belen
Panama 1519
(Colombia)
DISCOVERIES OF COLUMBUS
and Dates of Discovery
of Adjacent Territory
with names of
Countries of To-day
COPYRIGHT 1916, BY MUNN & CO. INC.
GENERAL DRAFTING CO., INC. N.Y.

21), was the first to pass through the Straits of Magellan, gave to the Pacific the flattering name it bears and his expedition circumnavigated the world though its leader perished in the Philippines. Among the other most notable circumnavigations were those of Sir Francis Drake (1577-80), during which he sailed along the Pacific coast of America from Magellan Straits nearly to Puget Sound, seeking in vain for a waterway into the Atlantic; Admiral Spilberg, who led a small Dutch fleet around the world (1614-17), incidentally defeating a Spanish fleet off Chile; and Captain James Cook, whose memorable voyages (1768-79) placed him first among British maritime discoverers.

It was early in the 16th century that Amerigo Vespucci, an Italian adventurer, claimed that he had made four voyages to America, though not as the commander of any expedition. The dates he gave were 1497, 1499, 1501 and 1503. From the time that his writings were critically examined by Alexander von Humboldt, the prevalent opinion has been that he had no part whatever in the first discovery of continental America. Professor Martin Waldseemüller of Lorraine unfortunately gave full credence to Vespucci's claims, wrote a book in 1507 in which he said the newly discovered continent should be called America because "Americus discovered it," and published the first map on which the name America appeared. It was the blunder of a scholar that attached the name America instead of "Columbia" to the Western World.

When John Cabot reached the northeastern coast of North America (1497) and landed on Cape Breton Island at the entrance to the Gulf of St. Lawrence, he believed he had reached the eastern shores of Asia. He returned home to announce the news and, the following year, went back to follow the whole coast and locate Japan in the south. This journey extended from Greenland nearly as far south as the latitude of Philadelphia, but as he found no signs of civilization and his supplies were running short, he returned to England.

V. Y. Pinson, who was helpful to Columbus on his first voyage, discovered in 1500 the estuary of the Amazon, the largest river in the world. This was about 17 years after Diego Cam found the mouth of the Congo, the second greatest river. About this time the idea began to weaken that the shores which explorers had been visiting were coasts of Asia. The population was too scanty and none of it was civilized; but still, no explorer was instructed to find what these new lands were worth and how they might be utilized. The main idea, for a long time, was to hunt for waterways through the new lands by which the spices of the East Indies and other coveted Asian commodities might be brought to the Atlantic countries of Europe without doubling the Cape of Good Hope.

It was while hunting for such a passage, and by reason of stress of weather, that Pedro Alvarez Cabral, in 1500, sighted the coast of Brazil, and took possession of it in the name of Portugal. In a half century, the whole Brazilian coast was studded with Portuguese settlements. The policy of appropriation and development was under way. The avowed *régime* of the Portuguese was to win new lands, if possible, by preaching the Gospel to the natives; if this failed, to subjugate them by the sword.

The romantic episode in coastal discovery was the voyage of Ponce de Léon, of Spain, in 1512, authorized by his government to search for and settle the fabulous island of "Bimini," on which was reputed to be a wonderful fountain that renewed the youth and strength of old men who bathed in it. He failed to find the fountain of youth, but his toil was not in vain, for he skirted a long coast covered with flowers

and he therefore called the land Florida and said he believed it was a great island.

In 1513, Vasco Nuñez de Balboa heard from an Indian chief that, south of the Isthmus of Panama, was another great ocean. Climbing to the summit of the Isthmian range, Balboa saw the Pacific; and arriving at the shore on September 29, he proclaimed the "Great South Sea" to be a possession of the Spanish king. He was planning to undertake the conquest of the Peruvians for the Spanish crown when the jealous governor of the Darien colony put him to death on a trumped up charge of disloyalty. The fate of Balboa, one of the ablest men in the Spanish service, was a pathetic incident in the early history of American discovery.

These data briefly summarize the leading events in discovery and early exploration along the eastern coasts of the Americas. Then followed the era of the penetration of the lands (16th-19th centuries). In North America, the gigantic task of studying the vast interior to the north of the Rio Grande was the work mainly of English and French explorers and European immigrants who followed in their wake. But many Spanish enterprises took root in the present Texas, New Mexico, Arizona and California. The Spanish over-ran the whole of Central and South America, excepting Brazil, seeking gold rather than orderly exploration and economic development, imposing upon the natives also the most cruel subjugation. But this eager quest for treasure so prodded exploratory zeal that South America was better known and mapped than North America towards the end of the 18th century.

In 1516, De Solis discovered and ascended the River Plata and was killed by Indians at the delta of the Paraná, near where Buenos Aires stands. In 1519-21, while Magellan was sailing around the world, Cortez, a military genius and a monster of cruelty, conquered Mexico and explored the Peninsula of Lower California. Among the great geographical results of the advancing Spanish conquest was the descent of the Amazon River from the Andes to the Atlantic by Orellana. In one of his wars with Indians, women fought beside the men of their tribe, which originated the name Amazons applied to female warriors. While the main river has been known for 300 years from the Andes to the sea, much of its basin between the main tributaries of the trunk stream still awaits detailed study.

The incentive to North American exploration was long the desire to find a northwest waterway leading to the Pacific. Jacques Cartier (1536) discovered the St. Lawrence River and ascended it to the site of Montreal. He saw the Ottawa from the top of Mount Royal, which gave Montreal its name. Champlain (1603-17), the greatest of Canadian explorers, founded the town of Quebec, traced the St. Lawrence to its source in Lake Ontario and reached Lake Huron. He was hoping all the time to find a waterway to China. Henry Hudson (1609) sailed into New York Bay and up the Hudson River to the site of Albany before he decided that the route would not lead to the Pacific. While on the same quest in Hudson Bay (1610), he and some of his men were set adrift by mutinous comrades and were not heard of again.

About 1660 the exploration of the continental interior without thought of reaching the Orient, became more prominent. It has often required a number of explorers to establish a geographical fact. Thus French explorers, chiefly missionaries, as Joliet and Marquette, revealed the Mississippi between its affluents, the Wisconsin and the Arkansas, within 700 miles of the Gulf of Mexico (1660-73). Father Hennepin (1680) traced the upper Mississippi between the mouth of the Illinois River and

the site of Minneapolis. Its lower course had been followed by Ferdinand de Soto (1541). De Soto has often been called the discoverer of the Mississippi, but the river was first sighted by Alonzo de Pineda in 1519. Its extreme sources and upper course were discovered and studied by later explorers, chiefly Schoolcraft (1832), Nicollet (1836), and Brower (1889).

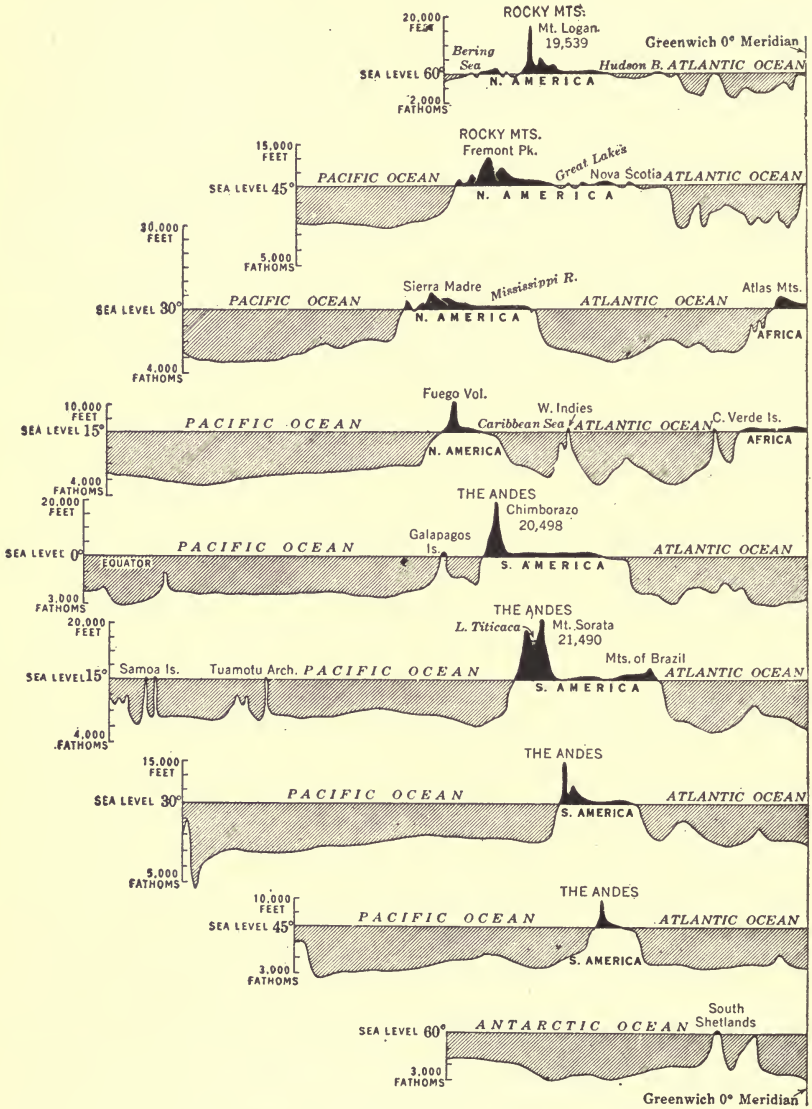
The exploration of the Great Lakes was distributed over many years. The pioneers who chopped their way through the forests from the Atlantic to the Mississippi, or opened farms in spite of Indian foes, in Kentucky, Tennessee and Ohio, the trappers and hunters spread over the western plains, the gold diggers who rushed to California, all added immensely to early knowledge of the United States.

In regions that have had from early time, comparatively dense population and rapid growth in civilization, we hear little of such research as that, for example, which has gridironed Africa with explorers' routes. Communities, such as Greece, Rome, China and Japan, as they grew in intellectual power, became intense students of their own habitat; and their armies, invading less fortunate lands, were the chief instrument of pioneer discovery. No large events in exploration have been possible in Europe within the Columbian era. Among the most important discoveries in Asia have been these: Deshnev rounded the East Cape (Cape Deshnev) in 1645, and thus made known the most eastern extension of the continent. Russia began the scientific exploration of Siberia in 1725 and, in the next twenty years, the northern coasts were fairly well determined and a foundation was laid for the detailed study of the land surface, fauna flora and inhabitants. Bering (1725-41) showed the relation between the northeast coast of Asia and the northwest coast of America. In the past fifty years, the great plains and forests have been studied, the Lena, Yenesei and Ob, three of the largest rivers in the world, have been explored and the Yenesei and Ob have irregular steamship connections with European ports. One result of the study of Siberia is that over 20,000,000 acres are now under the plow.

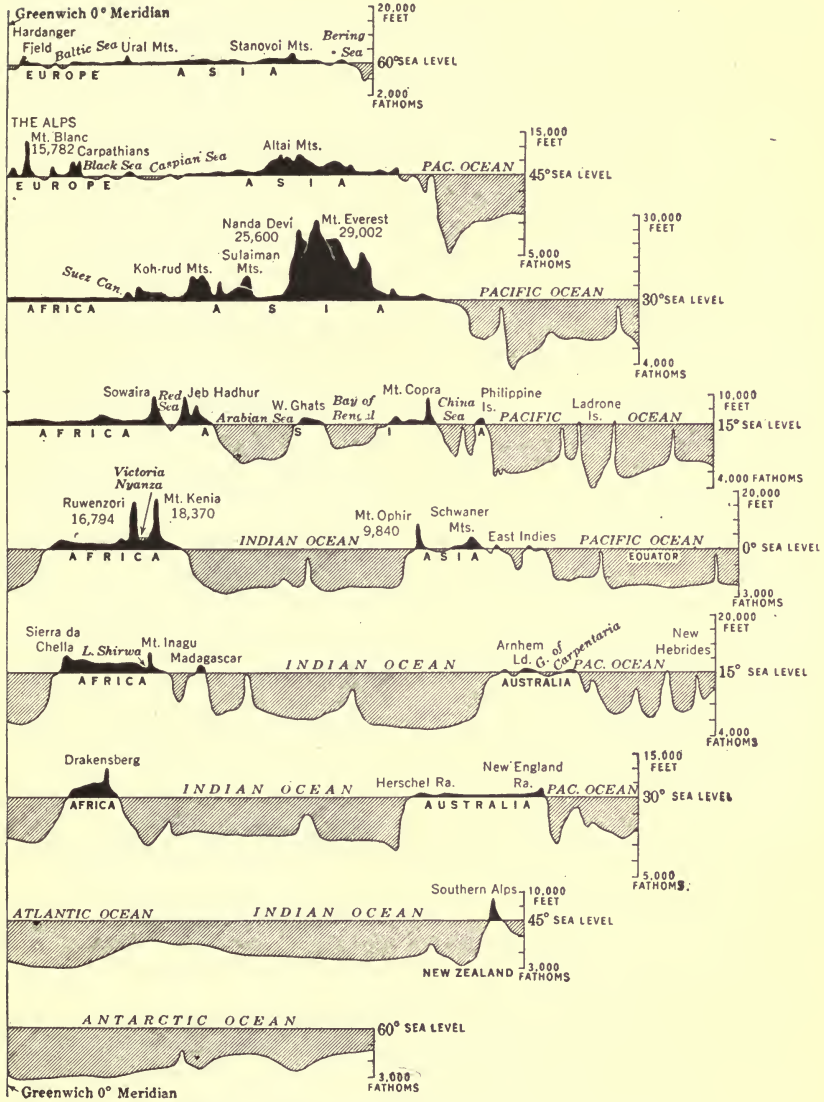
Tibet, so long a *terra incognita*, has been largely revealed, chiefly since 1863, by many explorers. The Himalayas have long been in process of detailed study by the Indian Survey, and India has been minutely mapped.

Australia was probably first seen about 1540 by French sailors, but it was early in the next century that the Dutch brought the first authentic accounts of parts of the west coast. Capt. James Cook's voyage (1769-70), when he surveyed the whole east coast, made the first great contribution to knowledge of the continent. Inland exploration did not begin till the early part of the 19th century. Attempts to penetrate the dry or desert regions of the interior with horses involved a number of tragedies, including the disappearance of the second Leichardt expedition (1847). Leichardt set out to cross the continent from east to west and was never heard from after he entered the desert. Not even in polar lands was exploration so hazardous as in Australia till the camel was introduced about 1865; then exploration advanced more rapidly and Australia is now known in all its chief configurations and conditions.

The attempt to reveal the whole of Africa did not begin till Dr. David Livingstone (1841-73) completed his great work. The exploration of the continent was greatly retarded by the difficulties of getting into it, owing to the lack of indentations, the high coasts, rivers reaching the sea by cataracts and rapids, the unfavorable climate and a host of hostile native tribes. The modern era of African exploration began when



Along Different Parallels of Latitude Round the Globe
Vertical Scale Exaggerated 260 Times
PROFILE OF LAND AND SEA



Along Different Parallels of Latitude Round the Globe
Horizontal Scale 1:150,000,000
PROFILE OF LAND AND SEA

Mungo Park made his journeys in the basin of the Niger River (1795-1806). During the next forty years, a few explorers crossed the Sahara and studied the western and central Sudan; and finally Dr. Livingstone gave thirty years of his life to many journeys of exploration in south-central Africa. He did not live to see the great effect of his work; but soon after his death (1873) the greatest exploratory movement ever seen began in Africa. Scores of expeditions carried on field studies that finally extended over nearly all of Africa south of the Sahara; and seven European nations—Great Britain, France, Belgium, Germany, Italy, Spain and Portugal—were finally in possession of the whole of Africa excepting Abyssinia and Liberia. Intensive studies of the various colonies began in the last years of the 19th century and continued till the war of 1914, when the entire work of development practically ceased. Africa, the last continent to be largely explored, has thus made far greater progress, in the short period of a generation, than any of its sister continents when they were in the same low stage of development.

Polar exploration began with the development of the whaling and fishing industries and the hunt for walrus, seal, etc., in the cold regions. Nearly 58,000 Greenland whales were killed in Spitzbergen waters in a little over a century, beginning in 1670. The search for the Northwest Passage to Asia also led into the Arctic as, for example, Davis's voyage up Baffin Bay. Then the quest for the North Pole engaged expeditions for many years; and finally, not a few parties were specially equipped to seek for facts about polar phenomena. Thus many polar lands have been discovered, depths of the polar seas have been ascertained in wide areas, the Arctic natives have been studied and the art of living and traveling in the frigid zones has been far advanced. The investigation of the position of the north and south magnetic poles appears to show that they are not fixed points but move in areas of considerable extent. The attainment of the geographical North Pole was made by Peary on April 6, 1909; and of the South Pole by Amundsen on December 14, 1911, and by Scott on January 18, 1912.

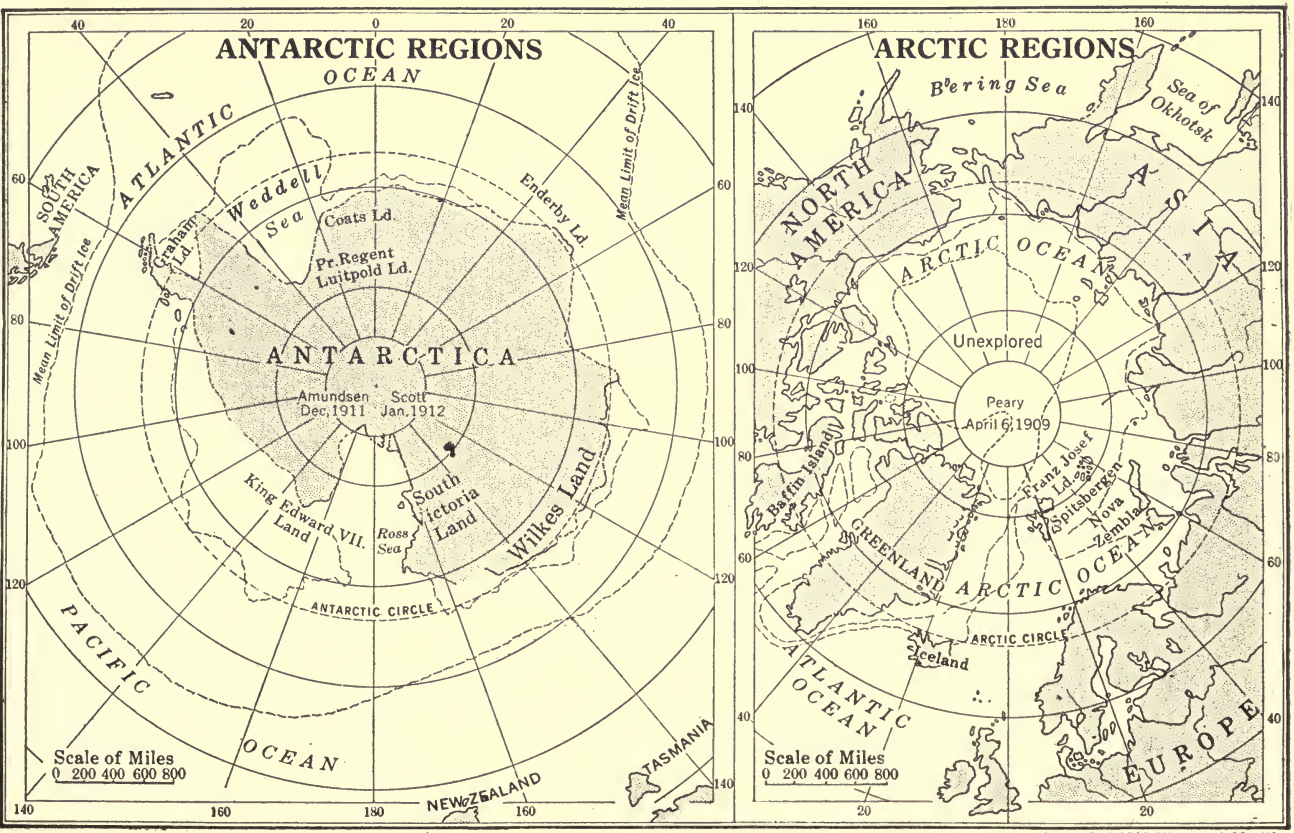
The most notable discovery in many years is the fact that a high continent surrounds the South Pole. The area of the land surface is approximately 5,460,000 square miles, or nearly one and a half times the size of Europe. It is computed that its mean height is 6,500 feet, or nearly seven times the mean elevation of Europe.

Copyright by Harris & Ewing

REAR ADMIRAL PEARY, DISCOVERER OF THE NORTH POLE

The great world sea has been so well explored that probably few islands have escaped attention except, it may be, in the polar areas.

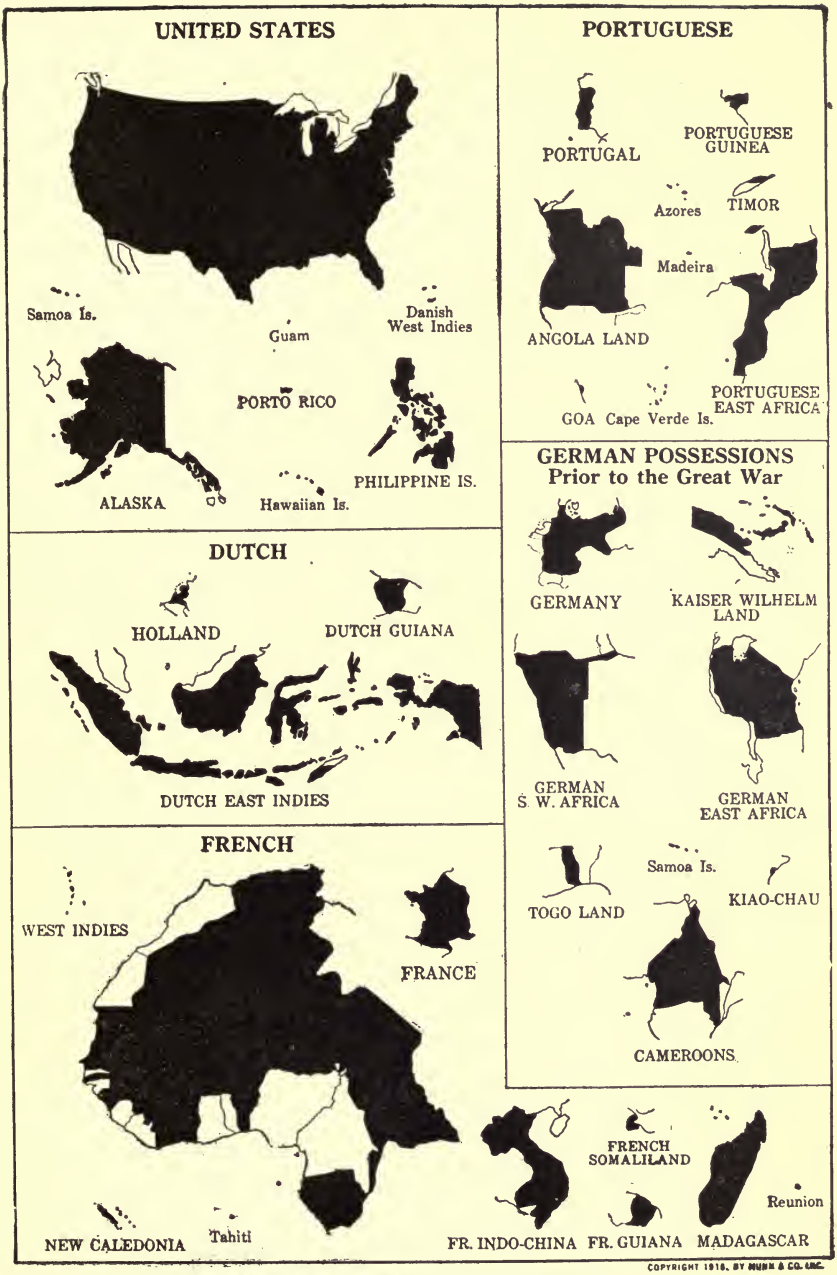
EARTHQUAKE AREAS AND VOLCANOES OF THE WORLD



THE PROGRESS OF DISCOVERY

Date	Explorer and Nationality.	Discovery or Exploration
B. C.		
1400–1250	Egyptians	Invasions of Habesh, Arabia, Phœnicia, Syria.
? 1350	Greeks	Argonautic expedition to Colchis.
1000	Phœnicians	Voyages to Ophir, Gades, Britain.
750	Greeks	Extension of Colonies in the Mediterranean and Pontus Euxinus.
700	Samians	Spain (Tartessus) discovered for the Greeks.
600	Phœnicians	Circumnavigation of Africa by order of Necho.
500	Himilco (Carthag.)	Atlantic coasts of Europe. Sargasso Sea. Said to have visited Britain.
500	Anaximander (of Miletus)	Makes the first maps.
500	Hecatæus (of Miletus)	Writes the first geography.
470	Hanno (Carthag.)	West Africa as far as Cape Palmas.
330	Pytheas of Massilia	? Thule, North Sea, Scandinavia.
330	Nearchus (Macedon.)	Sails from the Indus to Red Sea.
339-323	Alexander the Great	Expedition to Iran, Turan, and India.
290	Egyptians	Navigate the East coast of Africa.
218	Carthaginian	Hannibal crosses the Alps.
about 120	Eudoxus of Cyzicus	Attempts circumnavigation of Africa.
61–58	Romans	Julius Cæsar in Gaul, Germany, and Britain.
since 30	Romans	Extension of geographical knowledge and commerce as far as Central Asia.
20	Strabo (Greek)	Describes Roman Empire and first mentioned Thule and Ireland.
15	Romans	Tiberius discovers the Lake of Constance; Drusus, the Brenner Pass.
A. D.		
84	Romans	Agricola circumnavigates Britain.
150	Claudius Ptolemy (Egypt.)	Constructs his Geography and Atlas.
518–21	Hoei-sing (Chinese)	Visits Pamirs and Punjab.
671–95	I-tsing (Chinese)	Visits Java, Sumatra, and India.
861	Norsemen	Faroe Islands. North Cape of Europe rounded.
865	Naddod (Norse)	Discovers Iceland. Visited by Irish monks about 795.
876	Gunnbjorn (Norse)	Greenland coast. Rediscovered by Erik the Red (983).
985	Erik the Red (Norse)	Colonizes Greenland.
? 1000	Lyef Eiikson (son of Erik the Red)	Discovers Newfoundland (Helluland), Nova Scotia (Markland), and coast of New England (Vinland) [?].
1154	Edrisi (Sicily)	Geographer to King of Sicily, produces his geography.
about 1200	Arabs	Trading merchants discover Siberia.
1253	Ruysbroek	Reaches Karakorum, the ancient seat of the Mongol Empire.
1271–95	Marco Polo (Venet.)	Travels in Central Asia, China, India, Persia.
1290	Genoese	Canaries, Azores, etc.
1325–52	Ibn Batuta (Arab.)	Travels through the whole Mohammedan World, N. Africa, E. Africa, S. Russia, Arabia, India and China.
1327	Sir John Mandeville (Eng.)	? Travels in India.
1415–60	Prince Henry (Port.)	Gives an impetus to Portuguese voyages of discovery.
1419–20	J. Gonzales and Martin Vaz (Port.)	Porto Santo and Madeira discovered.
1442	Nuno Tristao (Port.)	Cape Verde, etc.
? 1460	Cintra and Costa (Port.)	Coast of Guinea reached.
1474	Toscanelli (Ital.)	Sends Columbus his map showing the western route to Cathay (China).
1485	Diego Cam (Port.)	Mouth of the Congo reached.
1487	Bartholomew Diaz (Port.)	Rounds Cape of Good Hope.
1492–98	Columbus (Gen.)	America, West Indies, Trinidad, Cuba, etc.
1497–98	John Cabot (Anglo-Ven.)	Sails along E. coast of America from Labrador as far as Florida.
1498	Vasco da Gama (Port.)	Route to India by Cape of Good Hope.

Great Britain and its Possessions



Other Countries and their Possessions.

THE PROGRESS OF DISCOVERY—*Continued*

Date	Explorer and Nationality	Discovery or Exploration
1499	Amerigo Vespucci (Ital.)	Claimed to have discovered Venezuela (which Columbus had already seen from the island of Trinidad). His testimony as to his three alleged voyages is regarded as untrustworthy.
1499	Pinzon, V. Y. (Span.)	Discovered mouth of R. Amazon and Cape St. Roque.
1500	Gaspar Corte Real (Port.)	Reaches entrance of Hudson Strait, called by him Strait of Anian. Rediscovered Greenland.
1500	Alvarez Cabral (Port.)	Brazil (named by him Ilha da Vera Cruz, being S. part of Bahia State).
1502	Columbus (Gen.)	Central America on his fourth voyage.
1512	Ponce de Leon (Span.)	Florida.
1513	Portuguese	Reach the Moluccas.
1513	Balboa (Span.)	Crosses Isthmus of Panama and discovers Pacific Ocean.
1516	De Solis (Span.)	Reaches La Plata.
1517	Sebastian Cabot (Eng.)	Hudson Strait.
1519–21	Cortez (Span.)	Conquest of Mexico.
1519–21	Magellan (Span.)	First to circumnavigate the globe. Passes through the Strait of Magellan, crosses the Pacific, and discovers the Philippines.
1534	Pizarro (Span.)	Completes the Conquest of Peru.
1535	Diego d'Almagro (Span.	Conquers Chili.
1535–42	Jacques Cartier (Fr.)	Gulf of St. Lawrence. Ascends river to Hochelaga (Montreal).
1539	Francesco de Ulloa (Span.)	Explores Gulf of California.
about 1540	French	Continent of Australia seen by French sailors.
1541	Pizarro and Orellana (Span.)	Amazon River.
1542	Antonio de Mota	First reaches Japan.
1542	Ruy Lopez de Villalobos (Span.)	Discovers Pelew Islands, and takes possession of Philippine Islands for Spain.
1542	Pinto (Port.)	Visits Japan.
1553	Sir H. Willoughby (Eng.)	Novaya Zemlia.
1576	Frobisher (Eng.)	Labrador and Baffin Land.
1577–80	Sir F. Drake (Eng.)	Second circumnavigation of the globe, and first saw Cape Horn. Explored W. coast of N. America nearly as far as Vancouver Archipelago.
1587	J. Davis (Eng.)	Davis Strait.
1594–97	Barents (Dut.)	Spitzbergen, Bear Islands, etc.
1595	Mendaña (Span.)	Discovers Marquesas Islands.
1606	Quiros (Span.)	Tahiti (Sagittaria) and other South Sea Islands.
1606	Torres (Span.)	Torres Strait. Dutch reach Australia.
1608	Champlain (French)	Discovers Lake Ontario.
1610	H. Hudson (Eng.)	Hudson Bay and discoveries in N. America.
1614–17	Spilbergen (Dut.)	Circumnavigation of the globe.
1616	W. Baffin (Eng.)	Enters Baffin Bay.
1616	LeMaire and Schouten (Dut.)	Round Cape Horn.
1616	Dirk Hartog (Dut.)	West coast of Australia.
1618	G. Thompson (Eng. merchant.)	Sails up Gambia.
1642	Abel Tasman (Dut.)	Van Diemen's Land (Tasmania) and New Zealand.
1643	Vries (Dut.)	Explores E. coast Japan, Saghalien, and Kurile Is.
1645	Deshnev (Cossack)	Rounds East Cape of Asia from the Kolyma to the Anadyr.
1660	French	Lake region of the St. Lawrence discovered.
1673	Marquette and Joliet (Fr.)	Exploration of the Mississippi from the north.
1725–43	Russians	Exploration of the coasts of Siberia.
1728 and '41	Bering (Dan.) and Tishirikov (Rus.)	Bering Strait and the NW. coast of America.
1764–66	Byron (Eng.)	Circumnavigation of the globe.

THE PROGRESS OF DISCOVERY—*Continued*

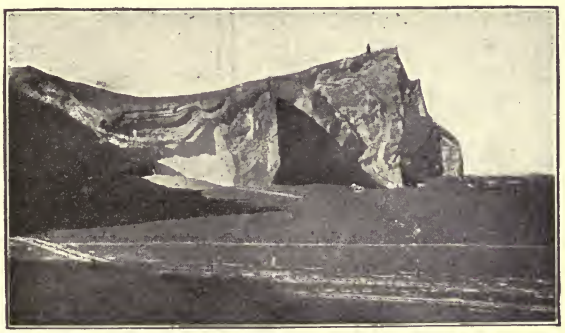
Date	Explorer and Nationality	Discovery or Exploration
1768–79	Capt. Cook (Eng.)	Voyages round the world. Hydrographical surveys of the Society Islands, Sandwich Islands, E. coast of Australia, Cook Strait in New Zealand, Antarctic Ocean, N.W. coast of America, etc.
1770	James Bruce (Scot.)	Sources of the Blue Nile.
1770	Liakhov (Russian)	Discovers New Siberian Islands.
1785–88	La Perouse (French)	North of Japan, Saghalien, etc.
1789	A. Mackenzie (Scot.)	Exploration of the Mackenzie River.
1792	Vancouver (Eng.)	Vancouver Island circumnavigated. Discovered by Perez, 1774. Exploration of NW. coast of America.
1795–1806	Mungo Park (Scot.)	Journeys and explorations in the Niger district.
1799–1858	Alex. von Humboldt (Ger.)	Explorations in South America and publication of "Kosmos."
1801–1804	Flinders (Eng.)	Southern coasts of Australia.
1803–6	Krusenstern (Rus.)	Surveys in Sea of Japan and Sea of Okhotsch, Saghalien, etc.
1805–9	Salt (Eng.)	Visit to Abyssinia.
1807–8	Klaproth (Ger.)	Exploration of the Caucasus.
1819	Sir E. Parry (Eng.)	Parry Archipelago.
1819 1825	Sir J. Franklin Richardson and Back (Eng.)	Coppermine and Mackenzie Rivers explored.
1819	Long (U. S.)	Exploration of Rocky Mountains.
1819	Wm. Smith (Eng.)	South Orkney Islands and South Shetlands. Visited by Weddell in 1822.
1819–20	Bellingshausen	Discovered new Antarctic Islands.
1821	Capt. King	Explorations in Western Australia.
1823	Wrangel (Rus.)	Discovers Wrangel Island.
1823	Denham and Clapperton (Eng.)	Lake Chad.
1823	James Weddell (Brit.)	Explored Weddell Sea.
1825–26	A. G. Laing (Scot.)	Reached Timbuktu from Tripoli.
1827–8	René Caillié (French)	Journey from Kakundi to Timbuktu and Morocco.
1829	Sturt (Eng.)	Descends the Murrumbidgee and discovers the Murray River.
1830–32	Biscoe (Eng.)	Enderby Land and Graham Land.
1830	.....	Royal Geographical Society founded in London.
1831	Sir J. C. Ross (Eng.)	Magnetic North Pole.
1832	Laird and Oldfield (Scot.)	Exploration of the Niger and Benué.
1833–35	Sir G. Back (Eng.)	Great Fish River, Canada.
1835	Sir M. R. Schomburgk (Ger.)	Explorations in Guiana.
1837	Wood (Eng.)	Discovered a source of the Oxus.
1837–40	John d'Urville (French)	Adélie Land. Reached 66° 30′ S. lat.
1839	J. Balleny (Eng.)	Balleny Islands, 66° 44′ S. lat.
1839–40	Eyre (Eng.)	Discovers Lake Torrens, S. Australia, and in 1841 journeys from Adelaide to King George's Sound.
1839–40	Lieut. Charles Wilkes (U. S.)	Discovery of the Antarctic Continent.
1840	Trümmer	Remains of ancient Nineveh.
1841	Sir James C. Ross (Eng.)	Victoria Land, with volcanoes Erebus and Terror.
1841–73	D. Livingstone (Scot.)	Thirty years' travel in Central South Africa.
1844–48	Leichhardt (Ger.)	Crosses Australia, Moreton Bay to Port Essington.
1845	Sir John Franklin (Eng.)	Sails on his last voyage never to return.
1848	Rebmann and Krapf (Ger)	Mt. Kilima Njaro. Sighted Mt. Kenia.
1849–55	Richardson and Barth (Eng.-Ger.)	Western Sudan and Sahara.
1850	Sir R. M'Clure (Irish)	Northwest Passage.
1852-4, 1861	Sir C. R. Markham (Eng.)	Explorations in Peru.
1855–59 1863–65	Du Chaillu (French)	Basin of Ogowé River, W. Africa.
1858	Sir R. Burton (Scot.)	Lake Tanganyika.
1858	Speke and Grant (Brit.)	Victoria Nyanza.

THE PROGRESS OF DISCOVERY—*Continued*

Date	Explorer and Nationality	Discovery or Exploration
1860	Sir S. Baker (Eng.)	Explores Upper Nile. Discovers Albert Nyanza, 1864.
1861	Burke and Wills	Crossed Australia.
1862	M'Douall Stuart (Scot.)	Crossed Australia.
1862–63	W. G. Palgrave (Eng.)	Journeys in Central and Eastern Arabia.
1864	A. E. Nordenskiöld (Swedish)	Spitzbergen.
1864–66	G. Rohlfs (Ger.)	Journeys in W. Sudan by Ghadames, Murzuk, and Wadai to R. Niger.
1867–72	Richthofen (Ger.)	Extensive travel and exploration in China.
1868–71	G. Schweinfurth (Ger.)	Exploration of the Jur, Niam-Niam, and Monbuttu countries in Africa.
1869	G. Nachtigal (Ger.)	Explorations in Lake Chad region and Central Sudan States.
1870–1886	Prejevalsky (Rus.)	Journeys in Mongolia, Tibet, etc.
1872	Payer and Weyprecht (Austrian)	Discovered Franz Josef Land.
1872–76	"Challenger" Expedition (Brit.)	Explores the depths of the oceans.
1872–76	Ernest Giles	Traverses Northwest Australia.
1873	Warburton (Irish)	Crosses Western Australia from East to West.
1874–75	Lieut. Cameron (Eng.)	Crosses Equatorial Africa.
1876	De Breeze (French)	Explorations in the Ogowé and Gabun region.
1876–90	H. M. Stanley (Eng.)	Congo Basin; Mt. Ruwenzori; Forests on the Aruwimi, etc.
1876	Sir Geo. Nares and A. H. Markham (Eng.)	Grant Land. Penetrated as far N. as 83° 20′.
1877–78	Doughty and Blunt (Brit.)	Explorations in Northern Arabia.
1878–79	Nordenskjöld (Swed.)	Northeast passage.
1878–89	Thomson (Scot.)	Journeys through Masai Land, British South Africa, Sokoto, Morocco, etc.
1878–85	Major Serpa Pinto (Port.)	Twice crosses Africa.
1878–92	Emin Pasha (Ger.)	Travels and Surveys in Equatorial Africa. Discovery of Semliki River, etc.
1879	Moustier and Zweifel (Swiss)	Sources of the Niger.
1879	Lieut. Schwatka (U. S.)	Recovered Franklin relics.
1881–82	Leigh Smith	Explored S. coast of Franz Josef Land.
1881–85	Greely (U. S.)	Grinnell Land and NW. coast of Greenland.
1885	Wissmann (Ger.)	Across Africa from West coast, Congo Basin.
1885	Junker (Rus.-Ger.)	Welle-Mobangi, etc.
1886–1909	Peary (U. S.)	Six expeditions of exploration and North Pole attained on April 6, 1909.
1887	Capt. Younghusband (Eng.)	Travels from Pekin to Kashmir.
1887	Hans Meyer (Ger.)	Exploration of Mount Kilimanjaro.
1888–1900	F. Foureau (French)	Explorations in the Sahara.
1890–02	Col. P. F. Monteil (French)	Researches in the Sudan and Sahara.
1892	Baron Toll (Russ.)	Explorations in the Lena R.
1893–96	Nansen (Norw.)	Hviotenland, etc.; reached his "Farthest North" in lat. 86° 13′ 6″ N.
1897	Jackson (Scot.)	Surveys and explorations in Franz Josef Land.
1893–97	Sven Hedin (Swed.)	Explorations in North Central Asia.
1895–96	Pr. Henri d'Orléans	Travels in Tonkin and China.
1896–98	Capt. Marchand	Travels from Upper Mobangi to Fashoda.
1897	Andrée (Swed.)	Attempt to cross over the North Pole in a balloon, with fatal results.
1897	D. Carnegie	Crosses Western Australia from S. to N.
1898–99	De Gerlache (Belgian)	"Belgica," first ship to winter within Antarctic circle.
1899–1900	Donaldson Smith (U. S.)	Explorations in Abyssinia and Brit. E. Africa.
1899–1903	Capt. Otto Sverdrup (Swedish)	Found new islands W. of Parry Islands.
1895–1900	Major Gibbons	Explorations in Congo and Zambezi headwaters.

THE PROGRESS OF DISCOVERY—*Continued*

Date	Explorer and Nationality	Discovery or Exploration
1900	Borchgrevink (Brit. Ex.)	Reached lat. 78° 50′ S. via Victoria Land.
1900	Duke of Abruzzi (Ital.)	Reached lat. 86° 33′ N. via Franz Josef Land.
1900–02	Sven Hedin (Swed.)	Explorations in Tibet.
1902–04	Anglo-Fr. and Anglo-Ger. Comms.	Surveys and discoveries in Bornu and Kamerun.
1901–04	Com. R. F. Scott (Brit.)	Explorations in Ross Sea and interior of Antarctic Continent.
1902–03	Prof. E. von Drygalski (Ger.)	Discovered Gaussberg on Antarctic Continent.
1903–04	Dr. W. S. Bruce (Brit.)	Discovery of Coats Land in Weddell Sea.
1904 and 1908–10	Dr. J. B. Charcot (French)	Explorations along Graham Land Coast and W. of it.
1906	Duke of the Abruzzi (Ital.)	First ascent of Mt. Ruwenzori.
1906–08	Sven Hedin (Swedish)	Tibet. Discovered main source of Brahmaputra.
1908–09	Lieut. Shackleton (Brit.)	Sledge journey towards the South Pole.
1910–11	Amundsen (Nor.)	Reached South Pole, Dec. 14, 1911.
1910–12	Capt. R. F. Scott (Brit.)	Reached South Pole, Jan. 18, 1912 and perished on return journey.
1911–12	Filchner (Ger.)	Discovered Prince Regent Leopold Land, Jan., 1912, on Antarctic Continent, Weddell Sea.
1913	Stefansson (Can.)	Discovered new land N. W. of Prince Patrick Island, Parry Islands.
1906-07	Mylius Erichsen	Completed maps of Greenland Coasts.
1909-12	Einar Mikkelsen	Explorations in Greenland Sea and East Greenland.
1912	Knud Rasmussen	Crossed North Greenland.
1913	J. P. Koch	Crossed Middle Greenland.
1913	Capt. B. A. Vilkitski	Discovered Nicholas II Land in the Arctic.
1913-14	Capt. Vilkitski	Made the second Northeast Passage.
1915	Sir Ernest Shackleton	Discovered Caird Coast of the Antarctic Continent.



LOOKING DOWN ON THE ANTARCTIC PLATEAU

"IT SHINES FOR ALL"

How the Statue of Liberty appears to the Alien. (This is not a photograph of the light itself, but a picture of the sun, taken at 6 P. M., from a steamship.)

CHAPTER II.

POPULATION

THE Thirteenth Census of the United States was taken by the Bureau of the Census as of April 15, 1910. The total area of enumeration included the United States, the territories of Alaska and Hawaii and Porto Rico. The enumeration also included persons stationed abroad in the military and naval service of the Government. the outlying possessions of the United States. Including the population of the Philippines and other possessions, the total population living under the American flag is approximately as given below.

It has been estimated by the United States Census Bureau that the population of the United States and possessions on July 1, 1914,

POPULATION OF THE UNITED STATES

Territory Enumerated: 1910	Gross area (land and water) in square miles	Population
United States (with outlying possessions)	3,627,557	93,402,151
United States, exclusive of outlying possessions	3,026,789	91,972,266
Outlying possessions	600,768	1,429,885
Alaska	590,884	64,356
Hawaii	6,449	191,909
Porto Rico	3,435	1,118,012
Military and naval service abroad	.....	55,608

The population returned for the total area of enumeration was 93,402,151, an increase, from 1900 to 1910, of 20.9 per cent for the total area of enumeration and 21 per cent for the United States, exclusive of outlying possessions.

It should be noted that the area of enumeration does not cover all

was 109,021,992, and that the population of the United States on July 1, 1915, was 100,399,318.

AREA

At the close of the First Census, in 1790, the United States comprised substantially the territory between the Atlantic Ocean and the Missis-

TOTAL POPULATION UNDER THE AMERICAN FLAG, 1910

Population of the United States and possessions	101,100,100
Enumerated at the census of 1910	93,402,151
Philippine Islands, 1903	7,635,426
Guam, estimated	9,000
Samoa, estimated	6,100
Panama Canal Zone, estimated	50,000

sippi River except Florida, representing a gross area (land and water surface) of 892,135 square miles. The United States, with its outlying possessions, now comprises a gross area of 3,743,306 square miles, or more than four times the area in 1790. The successive accessions of territory were as given below.

DENSITY OF POPULATION

According to the census of 1910, there were in the United States, on the average, 30.9 inhabitants to each square mile of land area. The relative density of population of each State of the United States in 1910 is best exhibited by the map on page 22.

Aside from the District of Columbia there were ten States in which there was in 1910 a population per square mile of more than 100, as follows: Rhode Island, 508.5 inhabitants per square mile; Massachusetts, 418.8; New Jersey, 337.7; Connecticut, 231.3; New York, 191.2; Pennsylvania, 171.0; Maryland, 130.3; Ohio, 117.0; Delaware, 103.0; Illinois, 100.6. There were 16 States which had, on the average, less than 18 inhabitants to the square mile. Nevada, with 0.7 person per square mile, or 7 persons to 10 square miles, had the lowest density.

Among the outlying possessions Alaska had an average density of only 0.1 per square mile; Hawaii, 29.8; and Porto Rico, 325.5, or greater than that of any State of the United States except Rhode Island, Massachusetts and New Jersey.

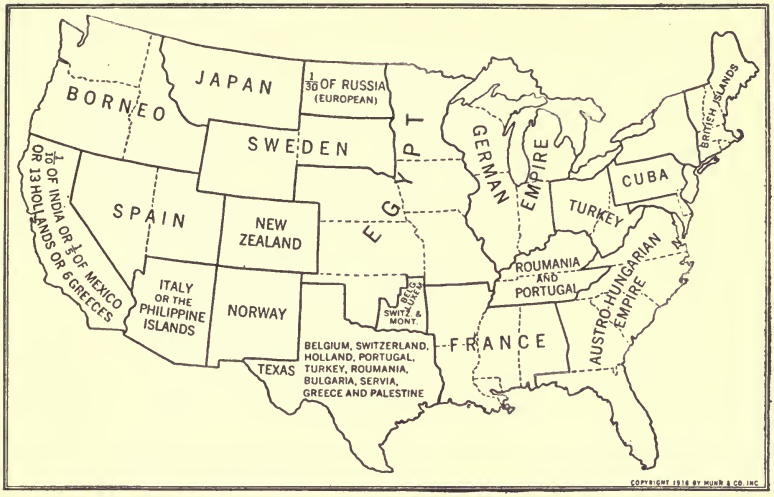
CENTER OF POPULATION

The center of population is often understood to be the point of intersection of a north and south line which divides the population equally, with an east and west line which likewise divides it equally. This point of intersection is, in a certain sense, a center of population; it is, however, designated by the Bureau of the Census as the median point to distinguish it from the point technically defined as the center.

The character of these two points may be made clear through a physical analogy. If the surface of the United States be considered as a rigid plane without weight capable of sustaining the population distributed thereon, individuals being assumed to be of equal weight, and each, therefore, to exert a pressure on any supporting pivotal point directly proportional to his distance from the point, the pivotal point on which the plane balances would, of course, be its center of gravity; and this is the point referred to by the term "center of population." In de-

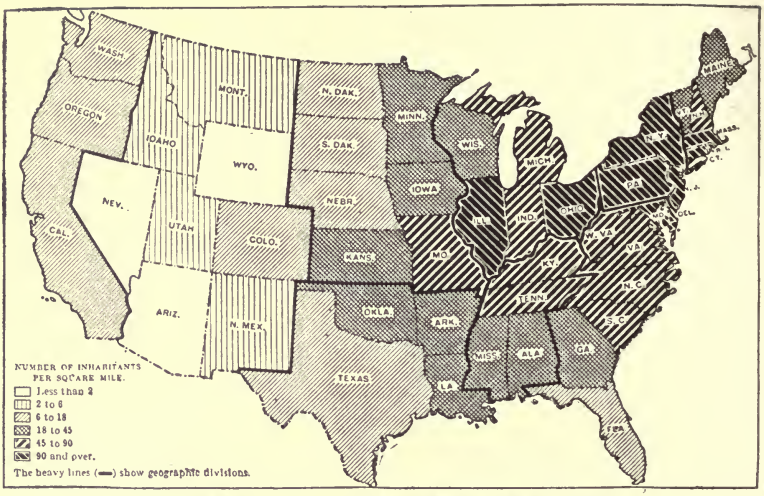
Accession	Gross area in square miles	Accession	Gross area in square miles
United States	3,026,789	Outlying possessions	716,517
Area of U. S. in 1790*	892,135	Alaska, 1867	590,884
Louisiana Purchase, 1803	827,987	Hawaii, 1898	6,449
Florida, 1819	58,666	Philippine Islands, 1899	115,026
Territory gained through treaty with Spain, 1819	13,435	Porto Rico 1899	8,435
Texas, 1845	389,166	Guam, 1899	210
Oregon, 1846	286,541	Samoa, 1900	77
Mexican Cession, 1848	529,189	Panama Canal Zone, 1904	436
Gadsden Purchase, 1853	29,670		

*Includes the drainage basin of the Red River of the North, not a part of any acquisition, but previously considered a part of the Louisiana Purchase.



COMPARATIVE AREA OF THE UNITED STATES AND FOREIGN COUNTRIES

UNITED STATES, ORIGINAL AREA AND ACQUISITIONS OF TERRITORY, 1790 TO 1910



POPULATION PER SQUARE MILE, BY STATES

termining the median point, distance is not taken into account, and the location of the units of population is considered only in relation to the intersecting median lines—as being north or south of the median parallel and east and west of the median meridian. Extensive changes in the geographic distribution of the population may take place without affecting the median point, whereas the center of population responds to the slightest population change in any section of the country.

CENTER OF POPULATION

At the time of the First Census, the center of population was 23 miles east of Baltimore, Maryland, since which time it has moved steadily westward. In 1800 it was 18 miles west of Baltimore; in 1810, 40 miles northwest by west from Washington, D. C.; in 1820, 16 miles north of Woodstock, Va.; in 1830, 19 miles west-southwest of Moorefield, W. Va.; in 1840, 16 miles south of Clarksburg, W. Va.; in 1850, 23 miles southwest of Parkersburg, W. Va.; in 1860, 20 miles south of Chillicothe, O.; in 1870, 48 miles east by north of Cincinnati, O.; in 1880, 8 miles west by south of Cincinnati, O.; in 1890, 20 miles east of Columbus, Ind.; in 1900, 6 miles southeast of Columbus, Ind., and finally, in 1910, in the city of Bloomington, Ind. During the 120 years between the First and Thirteenth Census, the center of population has moved over 550 miles westward, or in other words, from west latitude 76 degrees 11 minutes 12 seconds to west latitude 86 degrees 32 minutes 20 seconds.

MEDIAN POINT

As in the case of the center of population, the median point has also been moving westward, but not quite so rapidly. The exact location of the median point in 1880 was 16 miles nearly due west of Springfield, O.; in 1890, 5 miles southwest of Greenville, O.; in 1900, in Spartanburg, Ind., and finally, in 1910, 3 miles south of Winchester, Ind.

URBAN AND RURAL POPULATION

The Census Bureau classifies as urban population that residing in cities and other incorporated places of 2,500 inhabitants or more, includ-

DENSITY OF POPULATION OF THE WORLD

ing New England towns of that size. All other population is considered as rural.

In 1880, of a total population in the United States of 50,155,783, there were in municipalities 14,772,438, or 29.5 per cent of the population. In 1890, this element had grown to 22,720,223, or 36.1 per cent of the total population; in 1900, it was 30,797,185, or 40.5 per cent; and in 1910, 42,623,383, or 46.3 per cent of the total population of the United States.

From 1900 to 1910 the rate of increase for the population of urban areas was over three times that for the population living in rural territory, the rates of increase being 34.8 and 11.2 per cent respectively.

There were 14 States in 1910 in which more than half the population was living in territory classed as urban. The greatest per cent urban in any State was Rhode Island, which had 96.7 per cent, while North Dakota, with 11 per cent, had the smallest proportion of its people in urban communities.

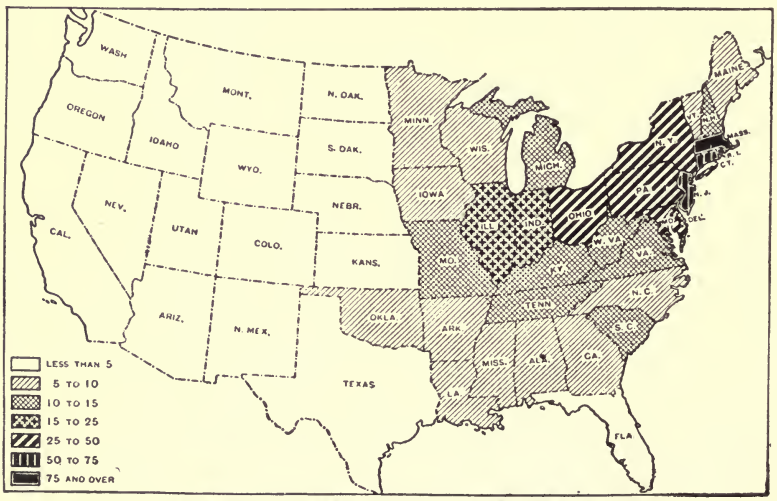
There was in every State between 1900 and 1910 an increase in urban population, but in six States—New Hampshire, Vermont, Ohio, Indiana, Iowa and Missouri—there was a decrease in rural population. In all but two States—Montana and Wyoming—the urban population increased faster than the rural population, and generally at a much more rapid rate.

COLOR OR RACE, NATIVITY AND PARENTAGE

Of the population of the United States in 1910, 81,731,957, or 88.9 per cent, were whites; 9,827,763, or 10.7 per cent, were negroes; and 412,546, or four-tenths of one per cent, were other colored races, including Indians, Chinese, Japanese, Hindus, Koreans, and others.

Of the total population, 78,456,380, or 85.3 per cent, were native and 13,515,886, or 14.7 per cent, foreign born, the latter consisting chiefly of whites.

The native white population numbered 68,386,412, and constituted 83.7 per cent of the white population and 74.4 per cent of the total population of the country. The 13,345,545 foreign-born whites consti-

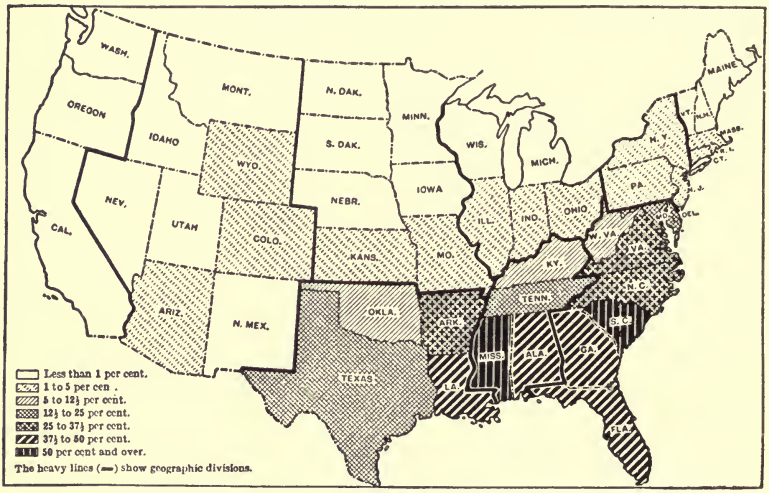


NUMBER OF FAMILIES PER SQUARE MILE

COMMERCIAL LANGUAGES OF THE WORLD

tuted 16.3 per cent of the white population and 14.5 per cent of the total population.

Native whites of native parentage in 1910 numbered 49,488,575, constituting 60.5 per cent of the white population and 53.8 per cent of the total population. Native whites of foreign parentage formed 15.8 per cent of the white population and those of mixed parentage 7.3 per cent, the corresponding percentages based on the total population being 14 and 6.5, respectively.



PER CENT OF NEGROES IN TOTAL POPULATION, BY STATES

Of the total increase of 15,977,691 in the population of the country between 1900 and 1910, the whites contributed 14,922,761, the negroes 993,769, and other races 61,161. The increase in the native population was 12,803,081, and that in the foreign-born, 3,174,610, or about one-fifth of the total increase.

The percentage of increase for the whites, 22.3, was a little less than twice as high as that for the negroes, 11.2. This difference is partly due, however, to the direct or indirect effect of immigration upon the increase of the white population. The native white population increased 20.8 per cent and the foreign-born white 30.7 per cent. The increase of negroes and Indians, since their numbers is only slightly affected by immigration, or emigration, is essentially a natural increase.

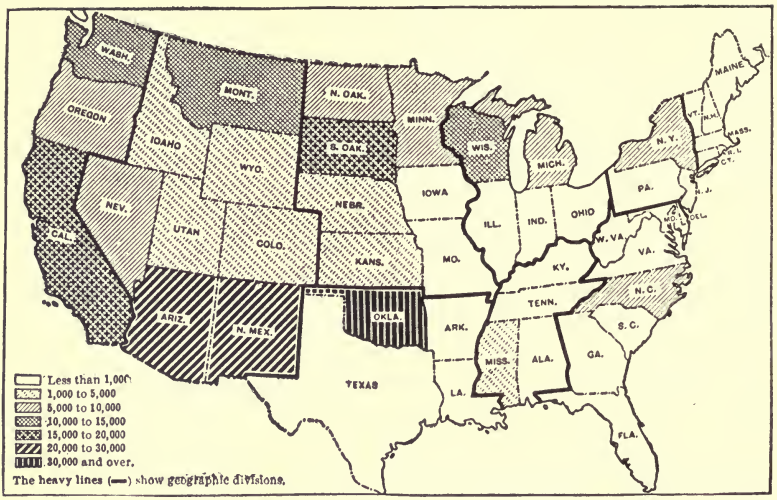
BLACK AND MULATTO POPULATION

Of the 9,827,763 negroes enumerated in 1910, 7,777,077 were returned as black and 2,050,686 as mulatto, or 20.9 per cent. In 1850 the percentage of mulattoes was 11.2. It had advanced but little in 1870, being only 12 per cent, but since 1870 the proportion of mulattoes in the total negro population appears to have increased materially, reaching 15.2 per cent in 1890, and, as given above, 20.9 per cent in 1910.

INDIAN, CHINESE AND JAPANESE POPULATION

Since 1890, the first census to include an enumeration of Indians in Indian territory and on Indian reservations, the Indian population has

RACES OF THE WORLD



DISTRIBUTION OF THE INDIAN POPULATION OF THE UNITED STATES, BY STATES

increased slightly, being 248,253 in 1890 and 265,683 in 1910. During the same period the Chinese population decreased from 107,488 in 1890 to 71,531 in 1910, while the Japanese population increased from 2,039 in 1890 to 72,157 in 1910. There were also enumerated in 1910 other non-white races, consisting, for the greater part, of Hindus and Koreans, to the number of 3,175.

PRINCIPAL CITIES

It may be of interest to consider the population of principal cities with respect to color, nativity and parentage. In only fourteen of the fifty cities having a population of over 100,000 did native whites of native parentage constitute as much as one-half of the total population. The proportion exceeded three-fifths in only four cities, Indianapolis, 64.5 per cent; Columbus, 64.4 per cent; Dayton, 62 per cent, and Kansas City, 61.9 per cent. On the other hand, in twenty-two of the cities of this class, less than one-third of the population were native whites of native parentage, over two-thirds in all but one of these cities consisting of foreign-born whites and their children. In Fall River only 13.3 per cent of the population were native whites of native parentage. In 10 cities of 100,000 inhabitants, or over, the population was more than one-third foreign-born white, namely, Fall River, 42.6 per cent; Lowell, 40.9 per cent; New York, 40.4 per cent; Paterson, 36.1 per cent; Boston, 35.9 per cent; Chicago, 35.7 per cent; Bridgeport, 35.5 per cent; Cleveland, 34.9 per cent; Providence, 34 per cent; and Detroit, 33.6 per cent.

The proportion of foreign-born whites was low in all of the southern cities. Among the northern cities it was lowest in Indianapolis (8.5 per cent) and Columbus (9 per cent). In many of the fifty cities having a population of over 100,000 the proportion of native whites of foreign or mixed parentage was nearly the same as the proportion of foreign-born whites. The native whites of foreign or mixed parentage were relatively most numerous in Milwaukee (48.8 per cent) and Fall River (43.7 per cent).

During the decade 1900-1910 the

POPULATION OF CITIES

OF THE

UNITED STATES

Census of 1910

Cities of over 100,000 population

Albany, N. Y.	100,253	Indianapolis, Ind.	233,650	Philadelphia, Pa.	1,549,008
Atlanta, Ga.	154,839	Jersey City, N. J.	267,779	Pittsburgh, Pa.	533,905
Baltimore, Md.	558,485	Kansas City, Mo.	248,381	Portland, Ore.	207,214
Birmingham, Ala.	132,685	Los Angeles, Cal.	319,198	Providence, R. I.	224,326
Boston, Mass.	670,585	Louisville, Ky.	223,928	Richmond, Va.	127,628
Bridgeport, Conn.	102,054	Lowell, Mass.	106,294	Rochester, N. Y.	218,149
Buffalo, N. Y.	423,715	Memphis, Tenn.	131,105	St. Louis, Mo.	687,029
Cambridge, Mass.	104,839	Milwaukee, Wis.	373,857	St. Paul, Minn.	214,744
Chicago, Ill.	2,185,283	Minneapolis, Minn.	301,408	San Francisco, Cal.	416,912
Cincinnati, Ohio.	364,463	Nashville, Tenn.	110,364	Scranton, Pa.	129,867
Cleveland, Ohio.	560,663	Newark, N. J.	347,469	Seattle, Wash.	237,194
Columbus, Ohio.	181,548	New Haven, Conn.	133,605	Spokane, Wash.	104,402
Dayton, Ohio.	116,577	New Orleans, La.	339,075	Syracuse, N. Y.	137,249
Denver, Colo.	213,381	New York, N. Y.	4,766,883	Toledo, Ohio.	168,497
Detroit, Mich.	465,766	Oakland, Cal.	150,174	Washington, D. C.	331,069
Fall River, Mass.	119,295	Omaha, Neb.	124,096	Worcester, Mass.	145,986
Grand Rapids, Mich.	112,571	Paterson, N. J.	125,600		

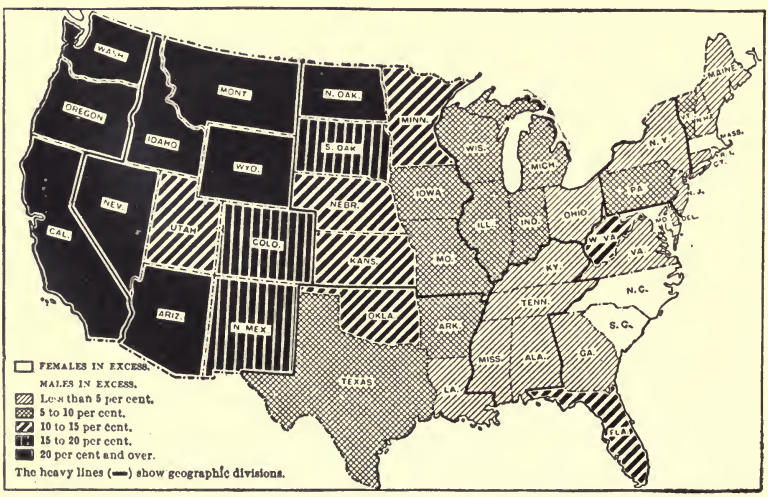
Cities of from 25,000 to 100,000 population

Akron, Ohio	69,067	Decatur, Ill.	31,140	Kansas City, Kans.	82,331
Allentown, Pa.	51,913	Des Moines, Iowa	86,368	Kingston, N. Y.	25,908
Altoona, Pa.	52,127	Dubuque, Iowa	38,494	Knoxville, Tenn.	36,346
Amsterdam, N. Y.	31,267	Duluth, Minn.	78,466	La Crosse, Wis.	30,417
Atlantic City, N. J.	46,150	Easton, Pa.	28,523	Lancaster, Pa.	47,227
Auburn, N. Y.	34,668	East Orange, N. J.	34,371	Lansing, Mich.	31,229
Augusta, Ga.	41,040	East St. Louis, Ill.	58,547	Lawrence, Mass.	85,892
Aurora, Ill.	29,807	El Paso, Tex.	39,279	Lewiston, Me.	26,247
Austin, Tex.	29,860	Elgin, Ill.	25,976	Lexington, Ky.	35,099
Battle Creek, Mich.	25,267	Elizabeth, N. J.	73,409	Lima, Ohio	30,508
Bay City, Mich.	45,166	Elmira, N. Y.	37,176	Lincoln, Neb.	43,973
Bayonne, N. J.	55,545	Erie, Pa.	66,525	Little Rock, Ark.	45,941
Berkeley, Cal.	40,434	Evansville, Ind.	69,647	Lorain, Ohio	28,883
Binghamton, N. Y.	48,443	Everett, Mass.	33,484	Lynchburg, Va.	29,494
Bloomington, Ill.	25,768	Fitchburg, Mass.	37,826	Lynn, Mass.	89,336
Brockton, Mass.	56,878	Flint, Mich.	38,550	Macon, Ga.	40,665
Brookline, Mass.	27,792	Fort Wayne, Ind.	63,933	McKeesport, Pa.	42,694
Butte, Mont.	39,165	Fort Worth, Tex.	73,312	Madison, Wis.	25,531
Camden, N. J.	94,538	Galveston, Tex.	36,981	Malden, Mass.	44,404
Canton, Ohio	50,217	Green Bay, Wis.	25,236	Manchester, N. H.	70,063
Cedar Rapids, Iowa	32,811	Hamilton, Ohio	35,279	Meriden, Conn.	27,265
Charleston, S. C.	58,833	Harrisburg, Pa.	64,186	Mobile, Ala.	51,521
Charlotte, N. C.	34,014	Hartford, Conn.	98,915	Montgomery, Ala.	38,136
Chattanooga, Tenn.	44,604	Haverhill, Mass.	44,115	Mount Vernon, N. Y.	30,919
Chelsea, Mass.	32,452	Hazleton, Pa.	25,452	Muskogee, Okla.	25,278
Chester, Pa.	38,537	Hoboken, N. J.	70,324	Nashua, N. H.	26,005
Chicopee, Mass.	25,401	Holyoke, Mass.	57,730	Newark, Ohio	25,404
Clinton, Iowa	25,577	Houston, Tex.	78,800	New Bedford, Mass.	96,652
Colorado Springs, Colo.	29,078	Huntington, W. Va.	31,161	New Britain, Conn.	43,916
Columbia, S. C.	26,319	Jackson, Mich.	31,433	Newburgh, N. Y.	27,805
Council Bluffs, Iowa.	29,292	Jacksonville, Fla.	57,699	Newcastle, Pa.	36,280
Covington, Ky.	53,270	Jamestown, N. Y.	31,297	Newport, Ky.	30,309
Dallas, Tex.	92,104	Johnstown, Pa.	55,482	Newport, R. I.	27,149
Danville, Ill.	27,871	Joliet, Ill.	34,670	New Rochelle, N. Y.	28,867
Davenport, Iowa	43,028	Joplin, Mo.	32,073	Newton, Mass.	39,806
		Kalamazoo, Mich.	39,437	Niagara Falls, N. Y.	30,445

Norfolk, Va.	67,452	St. Joseph, Mo.	77,403	Terre Haute, Ind.	58,157
Norristown, Pa.	27,875	Salem, Mass.	43,697	Topeka, Kans.	43,684
Ogden, Utah.	25,580	Salt Lake City, Utah.	92,777	Trenton, N. J.	96,815
Oklahoma City, Okla.	64,205	San Antonio, Tex.	96,614	Troy, N. Y.	76,813
Orange, N. J.	29,630	San Diego, Cal.	39,578	Utica, N. Y.	74,419
Oshkosh, Wis.	33,062	San Jose, Cal.	28,946	Waco, Tex.	26,425
Pasadena, Cal.	30,291	Savannah, Ga.	65,064	Waltham, Mass.	27,834
Passaic, N. J.	54,773	Schenectady, N. Y.	72,826	Warwick, R. I.	26,629
Pawtucket, R. I.	51,622	Sheboygan, Wis.	26,398	Waterbury, Conn.	73,141
Peoria, Ill.	66,950	Shenandoah, Pa.	25,774	Waterloo, Iowa.	26,693
Perth Amboy, N. J.	32,121	Shreveport, La.	28,015	Watertown, N. Y.	26,730
Pittsfield, Mass.	32,121	Sioux City, Iowa.	47,828	West Hoboken, N. J.	35,403
Portland, Me.	58,571	Somerville, Mass.	77,236	Wheeling, W. Va.	41,641
Portsmouth, Va.	33,190	South Bend, Ind.	53,684	Wichita, Kans.	52,450
Poughkeepsie, N. Y.	27,936	South Omaha, Neb.	26,259	Wilkes-Barre, Pa.	67,105
Pueblo, Colo.	44,395	Springfield, Ill.	51,678	Williamsport, Pa.	31,860
Quincy, Ill.	36,587	Springfield, Mass.	88,926	Wilmington, Del.	87,411
Quincy, Mass.	32,642	Springfield, Mo.	35,201	Wilmington, N. C.	25,748
Racine, Wis.	38,002	Springfield, Ohio.	46,921	Woonsocket, R. I.	38,125
Reading, Pa.	96,071	Stamford, Conn.	25,138	Yonkers, N. Y.	79,803
Roanoke, Va.	34,874	Superior, Wis.	40,384	York, Pa.	44,750
Rockford, Ill.	45,401	Tacoma, Wash.	83,743	Youngstown, Ohio.	79,066
Sacramento, Cal.	44,696	Tampa, Fla.	37,782	Zanesville, Ohio.	28,026
Saginaw, Mich.	50,510	Taunton, Mass.	34,259		

foreign-born white population in New York City advanced from 1,260,918 to 1,927,703, an increase of 666,785, while native whites of native parentage increased only 183,841. In 1910 only 19.3 per cent of the city's population consisted of native whites of native parentage. Of the total population of the United States approximately one-twentieth is domiciled in New York City; of the native whites of native parentage, one-fiftieth; of the native whites of foreign or mixed parentage, one-tenth; and of the foreign-born, one-seventh.

Among the larger cities the proportion of negroes in 1910 was highest in Memphis, 40 per cent, followed by Birmingham, with 39.4 per cent; Richmond, 36.6 per cent; Atlanta, 33.5 per cent; Nashville, 33.1 per cent; Washington, 28.5 per cent; New Orleans, 26.3 per cent; Louis-



PROPORTION OF MALES TO FEMALES IN THE TOTAL POPULATION, BY STATES

COPYRIGHT 1916 BY MUNN & CO. INC.

RELIGIONS OF THE WORLD

ville, 18.1 per cent; and Baltimore, 15.2 per cent. In no other city of over 100,000 inhabitants did the negro element amount to one-tenth of the population. Classified according to numbers, the following cities returned more than 50,000 negroes in 1910: Washington, 94,446; New York, 91,709; New Orleans, 89,262; Baltimore, 84,749; Philadelphia, 84,459; Memphis, 52,441; Birmingham, 52,305; and Atlanta, 51,902.

CLASSIFICATION OF POPULATION BY SEX

There were in the United States in 1910, 47,332,277 males and 44,639,989 females, or 106 males to each 100 females.

The excess of males in the United States is partly due to extensive immigration, a much larger proportion of the immigrants being males than females. In the native white population of the United States, however, there is also an excess of males over females, the ratio in 1910 being 102.7 males to each 100 females.

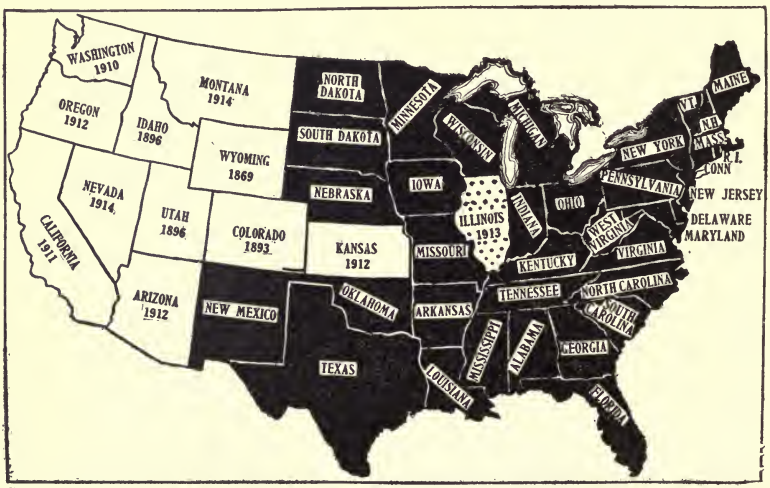
POPULATION 21 YEARS OF AGE AND OVER

Persons 21 years of age and over have certain special legal rights with reference to property, the elective franchise, and other matters. This class of the population is further significant from the social and economic standpoint, in that it includes the great majority of breadwinners and also the great majority of married men and women. From the political standpoint particular interest attaches to statistics regarding males 21 years of age and over, although in several States women of that age also now have the right to vote at all elections.

For the United States, exclusive of Alaska, Hawaii, Porto Rico, and other outlying possessions, the total population 21 years of age and over in 1910 was 51,554,905, representing 56.1 per cent of the total population of all ages. Of this number, 26,999,151, or 29.4 per cent of the total population, were males, and 24,555,754 were females.

MALES OF MILITIA AGE

Men from 18 to 44 years of age, inclusive, are subject to militia duty under the laws of most States, and



Courtesy Literary Digest

WOMAN'S SUFFRAGE—DISTRIBUTION OF VOTERS
White indicates Suffrage; dotted, limited Suffrage, and black, male Suffrage only.

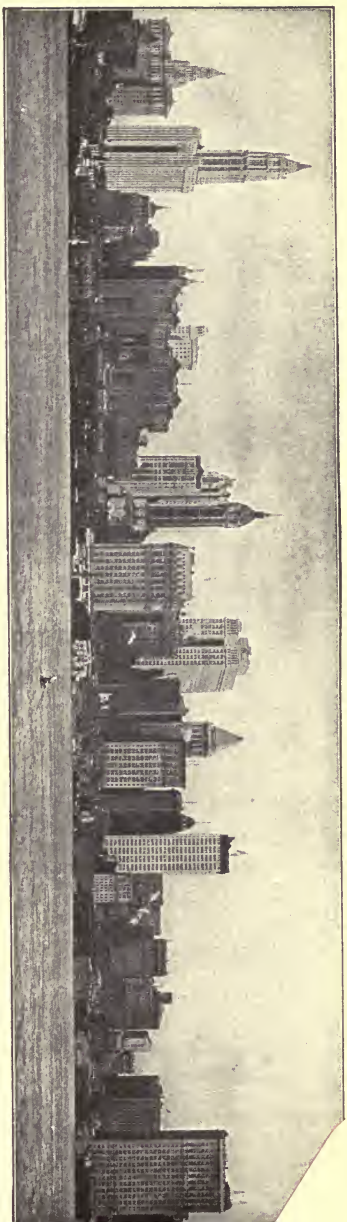
represent substantially the theoretical fighting strength of the country in case of war. The total number of males from 18 to 44 years of age in 1910 was 20,473,684, representing 22.3 per cent of the total population of the country and 43.3 per cent of the total male population.

IMMIGRATION

Immigration into the United States has experienced a marked reduction as a result of the European war, dropping from a total of 1,218,480 for the year ended June 30, 1914, to 326,700, and 298,826 for the years ended June 30, 1915 and 1916, respectively. This falling off is not of a temporary nature, but is certain to continue for many years, even after the close of the war.

Of the 298,826 immigrant aliens admitted during the year ended June 30, 1916, 9,795 had been engaged in the professions, 45,528 were skilled laborers, 138,737 had been engaged in miscellaneous occupations, and 104,766 (including the women and children) reported no occupation. Of the 129,765 emigrant aliens departed, 2,097 had been engaged in the professions, 13,874 were skilled laborers, 96,405 had been engaged in miscellaneous occupations and 17,389 (including the women and children) reported no occupation.

Eighteen thousand eight hundred and sixty-seven persons were debarred during the year. Of this number, 10,383 were debarred as being likely to become public charges, 1,153 as having a loathsome or dangerous contagious disease, 1,657 as of mental defects (other than idiots, imbeciles and insane) and 2,080 as being contract laborers. There were 2,906 persons deported after landing, of which number 1,081 were deported because of the possibility of becoming public charges, 282 for insanity, 360 for having entered without inspection, 114 as criminals and 100 for loathsome or dangerous diseases.



NEW YORK'S BILLION DOLLAR SKY LINE AS SEEN BY THE IMMIGRANT

OCCUPATIONS

At the Thirteenth Census there were 38,756,223 persons ten years of age and over engaged in gainful occupations in the United States, including Alaska, Hawaii, Porto Rico, and the military and naval stations abroad. The gainful workers thus formed 41.5 per cent of the total population.

In continental United States the gainful workers numbered 38,167,336, which was 41.5 per cent of the total population and 53.3 per cent of the population ten years of age and over. In the male population the gainful workers numbered 30,091,564, which was 81.3 per cent of the males ten years of age and over. In the female population the gainful workers numbered 8,075,772, which was 23.4 per cent of all females ten years of age and over. Thus, in the population ten years of age and over, more than one-half of all persons, over four-fifths of the males, but

IMMIGRATION INTO THE UNITED STATES, 1910–1916

Races	Years Ended June 30—						
	1910	1911	1912	1913	1914	1915	1916
African (black)	4,966	6,721	6,759	6,634	8,447	5,660	4,576
Armenian	5,508	3,092	5,222	9,353	7,785	932	964
Bohemian and Moravian	8,462	9,223	8,439	11,091	9,928	1,651	642
Bulgarian, Serbian, Montenegrin	15,130	10,222	10,657	9,087	15,084	3,506	3,146
Chinese	1,770	1,307	1,608	2,022	2,354	2,469	2,239
Croatian and Slovenian	39,562	18,982	24,366	42,499	37,284	1,942	791
Cuban	3,331	3,914	3,155	3,099	3,539	3,402	3,442
Dalmatian, Bosnian, Herzegovinian	4,911	4,400	3,672	4,520	5,149	305	114
Dutch and Flemish	13,012	13,862	10,935	14,507	12,566	6,675	6,443
East Indian	1,782	517	165	188	172	82	80
English	53,498	57,258	49,689	55,522	51,746	38,662	36,168
Finnish	15,736	9,779	6,641	12,756	12,805	3,472	5,649
French	21,107	18,132	18,382	20,652	18,166	12,636	19,518
German	71,380	66,471	65,343	80,865	79,871	20,729	11,555
Greek	39,135	37,021	31,566	38,644	45,881	15,187	26,792
Hebrew	84,260	91,223	80,595	101,330	138,051	26,497	15,108
Irish	38,382	40,246	33,922	37,023	33,898	23,503	20,636
Italian (north)	30,780	30,312	26,443	42,534	44,802	10,660	4,905
Italian (south)	192,673	159,638	135,830	231,613	251,612	46,557	33,909
Japanese	2,798	4,575	6,172	8,302	8,941	8,609	8,711
Korean	19	8	33	64	152	146	154
Lithuanian	22,714	17,027	14,078	24,647	21,584	2,638	599
Magyar	27,302	19,996	23,599	30,610	44,538	3,604	981
Mexican	17,760	18,784	22,001	10,954	13,089	10,993	17,198
Pacific Islander	61	12	3	11	1	6	5
Polish	128,348	71,446	85,163	174,365	122,657	9,065	4,502
Portuguese	7,657	7,469	9,403	13,566	9,647	4,376	12,208
Roumanian	14,199	5,311	8,329	13,451	24,070	1,200	953
Russian	17,294	18,721	22,558	51,472	44,957	4,459	4,858
Ruthenian (Russniak)	27,907	17,724	21,965	30,588	36,727	2,933	1,365
Scandinavian	52,037	45,859	31,601	38,737	36,053	24,263	19,172
Scotch	24,612	25,625	20,293	21,293	18,997	14,310	13,515
Slovak	32,416	21,415	25,281	27,234	25,819	2,069	577
Spanish	5,837	8,068	9,070	9,042	11,064	5,705	9,259
Spanish American	900	1,153	1,342	1,363	1,544	1,667	1,881
Syrian	6,317	5,444	5,525	9,210	9,023	1,767	676
Turkish	1,283	918	1,336	2,015	2,693	273	216
Welsh	2,244	2,248	2,239	2,820	2,558	1,390	983
West Indian (except Cuban)	1,150	1,141	1,132	1,171	1,396	823	948
Other peoples	3,330	3,323	3,660	3,038	3,830	1,877	3,388
Total	1,041,570	878,587	838,172	1,197,892	1,218,480	326,700	298,826

Photo by Irving Underhill
ELLIS ISLAND, AMERICA'S GREATEST GATEWAY

less than one-fourth of the females, were gainfully occupied.

In the States the proportion of the population ten years of age and over engaged in gainful occupations in 1910 ranged from 46.9 per cent in Iowa to 68 per cent in Mississippi. The States having the smallest proportions were: Iowa, 46.9 per cent; Kansas, 47 per cent; Nebraska, 47.7 per cent; Utah, 47.9 per cent; and Indiana 48 per cent. The States having the largest proportion were North Carolina, 60 per cent; Georgia, 61.5 per cent; Wyoming, 62.6 per cent; Nevada, 64.3 per cent; Alabama, 64.7 per cent; South Carolina, 67.6 per cent; and Mississippi, 68.7 per cent. Except in three States —Arizona, Montana and North Dakota—there was an increase, from 1900 to 1910, in the proportion of the population ten years of age and over engaged in gainful occupations. The States showing the largest increases were Alabama, Arkansas, Georgia, Mississippi, Nevada, North Carolina, South Carolina and Texas.

DEATHS IN REGISTRATION AREA

The total number of deaths returned from the registration area of the United States for the year 1914 was 898,059. The estimated mid-

NUMBER AND PROPORTION OF PERSONS IN GENERAL DIVISIONS OF OCCUPATIONS

Occupation	Total	Per Cent of Gainful Workers
All occupations	38,167,336	100.0
Agriculture, forestry, and animal husbandry	12,619,203	33.2
Extraction of minerals (mining and quarrying)	964,824	2.5
Manufacturing and mechanical industries	10,658,881	27.9
Transportation	2,637,671	6.9
Trade	3,614,670	9.5
Public Service	459,291	1.2
Professional Service	1,663,569	4.4
Domestic and Personal Service	3,772,174	9.9
Clerical Occupations	1,737,053	4.6

year population of this area was 65,989,295, or 66.8 per cent of the total population of the United States. The death rate for the year was 13.6 per one thousand population, the lowest on record since the establishment of the registration area in 1880, being 19.8 in 1880, 19.6 in 1890, 17.6 in 1900, 16.0 in 1905, 15.0 in 1910 and 14.1 in 1913.

The deaths among the white population numbered 824,319, or 917.9 for every thousand deaths. Of this number, 605,349 were native born; 327,696 had both parents native; 203,189 had one or both parents foreign born; and 74,464 of unknown parentage. Other deaths among the white population were 207,272 foreign born, and 11,698 unknown. The deaths among the colored population, numbering 73,740, or 82.1 for every thousand deaths, were divided as follows: Negro, 70,429; Chinese, 1,018; Japanese, 904; Indian, 1,369; and other colored, 20.

Of the total number of deaths 491,416 were males, and 406,643 were females. The total number of deaths among children less than one year of age was 155,075; of those from one to five years of age, 58,045; from five to twenty-five, 86,355; from twenty-five to fifty, 196,087; from fifty to seventy-five, 217,207; over seventy-five, 123,963, of which 467 were one hundred years of age or over; and of ages unknown, 1,327. Out of every thousand deaths 172.7 occurred before the end of the first year of life; 96.2 between the ages of five and twenty-five; 218.5 between the ages of twenty-five and fifty; 307.6 between the ages of fifty and seventy-five; and 138.0 over seventy-five years of age.

The number of deaths in the registration area during 1914 from various causes were as follows: Typhoid fever, 10,188; malaria, 1,477; smallpox, 212; measles, 4,461; scarlet fever, 4,340; whooping cough, 6,816; diphtheria and croup, 11,786; influenza, 6,014; other epidemic diseases, 6,125; tuberculosis, 96,903; cancer, 52,420; diabetes, 10,666; diseases of the nervous system and organs of special sense, 87,614; diseases of the circulatory system, 123,901; diseases of the respiratory system, 104,086; diseases of the digestive system, 99,673; non-venereal diseases of the genito-urinary system, 78,023; suicide, 10,933; homicide, 4,847; and other external causes, 51,770.

The death rate per 100,000 of population for the more important causes was as follows: Typhoid fever, 15.4; malaria, 2.2; measles, 6.8; scarlet fever, 6.6; whooping cough, 10.3; diphtheria and croup, 17.9; influenza, 9.1; tuberculosis, 146.8; cancer, 79.4; diabetes, 16.2; diseases of the nervous system and organs of special sense, 132.8; diseases of the circulatory system, 187.8; diseases of the respiratory system, 157.7; diseases of the digestive system, 151.0; non-venereal diseases of the genito-urinary system, 118.2; suicide, 16.6; homicide, 7.3, and other external violence, 78.5.

CHAPTER III.

AGRICULTURE

By C. H. CLAUDY

THE unthinkable number is one which conveys no idea to the mind—a number so large that one twice as large or half as large makes the same impression.

Such a number measures the dollars which value the agricultural production of the United States in a year. To say that the total estimated value of all crops and animal products for the year ending June 30, 1915, is $10,501,686,375 conveys small impression of its real worth.

If a man could keep awake twenty-four hours in a day, and could live for a hundred years under such conditions, he would have to spend during every waking minute of his life something more than $199 to dispose of this sum in the hundred years.

If the sum were handed him in $5,000 lots, he could not write fast enough, working every minute of every day and every night, to make out deposit slips to put it in a bank in a year's time. It represents a hundred dollars for every man, woman and child in the country. If the cost of the Panama Canal is $500,000,000, one year's crops would build twenty such canals! If it costs Europe $20,000,000 a day to have a war, then we could finance it for them for seventeen months with the agricultural products of one year.

SCENE ALONG THE BRANDYWINE, SHOWING TYPICAL CHESTER COUNTY (PA.) TOPOGRAPHY

AGRICULTURAL INFORMATION

It is, of course, an impossibility to do more than indicate the extent of agriculture or its immense importance not only to the United States but to the world. Those who wish particular facts of any special subject can obtain Volume V. of the

Census of 1910, which gives figures for 1909 in 927 closely printed pages, many tables and graphic drawings, or the Year Book of the Department of Agriculture, which has a number of "graphs" as well as 174 pages of finely printed statistics. Best of all, however, for the man interested in some one special phase of this question is the opportunity afforded him by correspondence with the Department of Agriculture. Inquiries on any subject connected with agriculture receive prompt attention in Uncle Sam's greatest department and information to answer any inquiry is either on hand or will be obtained for any inquirer.

GENERAL STATISTICS

The total area of the United States is 1,903,269,000 acres. Of this 46.2 per cent is productive land; that is, land which is capable of being turned into farm, grazing or tillable area, exclusive of any possible future engineering developments in the reclamation field which may make vast areas, now arid, agricultural possibilities.

Of this 46.2 per cent of productive land, 293,794,000 acres (1910 census figures, latest available), representing 15.4 per cent of the total area, are under cultivation.

Thirty-six of the principal agricultural countries of the world have 30.5 per cent of their total area possibly productive and but 8.7 of their total area under production. With a ratio of approximately one to four for the world, then, the United States has approximately one to three (one-third) of its agricultural possibilities developed.

FUTURE OF AGRICULTURE IN THE UNITED STATES

The United States, in spite of its showing in area and its leadership of the world in the world's principal crops, can by no means be considered to have even begun to realize its agricultural possibilities. It can triple its area under cultivation with the same methods and the same productiveness and still fall far behind the averages of other countries which have been compelled to make intensive agriculture a

INCREASE IN VALUE OF FARM PRODUCTS
(BASED ON PRICES AT THE FARM)

Year	Total, gross	Crops		Animals and animal products	
		Value	Percentage of total	Value	Percentage of total
1879 (census)	$2,212,540,927	.....	....	.....	....
1889 (census)	2,460,107,454	.....	....	.....	....
1897	3,960,821,685	$2,519,082,592	63.6	$1,441,739,093	36.4
1898	4,338,945,829	2,759,569,547	63.6	1,579,376,282	36.4
1899 (census)	4,717,069,973	2,998,704,412	63.6	1,718,365,561	36.4
1900	5,009,595,006	3,191,941,763	63.7	1,817,653,243	36.3
1901	5,302,120,039	3,385,179,114	63.8	1,916,940,925	36.2
1902	5,594,645,072	3,578,416,465	64.0	2,016,228,607	36.0
1903	5,887,170,104	3,771,653,816	64.1	2,115,516,288	35.9
1904	6,121,778,001	3,981,675,866	65.0	2,140,102,135	35.0
1905	6,273,997,362	4,012,652,758	64.0	2,261,344,604	36.0
1906	6,764,210,423	4,263,134,353	63.0	2,501,076,070	37.0
1907	7,487,988,622	4,761,111,839	63.6	2,726,876,783	36.4
1908	7,890,625,522	5,098,292,549	64.6	2,792,332,973	35.4
1909 (census)	8,558,161,223	5,487,161,223	64.1	3,071,000,000	35.9
1910	9,037,390,744	5,486,373,550	60.7	3,551,017,194	39.3
1911	8,819,174,959	5,562,058,150	63.1	3,257,116,809	36.9
1912	9,342,790,149	5,842,220,449	62.5	3,500,569,700	37.5
1913	9,849,512,511	6,132,758,962	62.3	3,716,753,549	37.7
1914	9,894,960,531	6,111,684,020	61.8	3,783,276,511	38.2
1915 estimate)	10,501,686,375	6,652,288,634	63.3	3,849,397,741	36.7

WORLD'S COMMERCIAL CULTIVATION

study, from the potato field to the orchard, the grazing field to the wheat field.

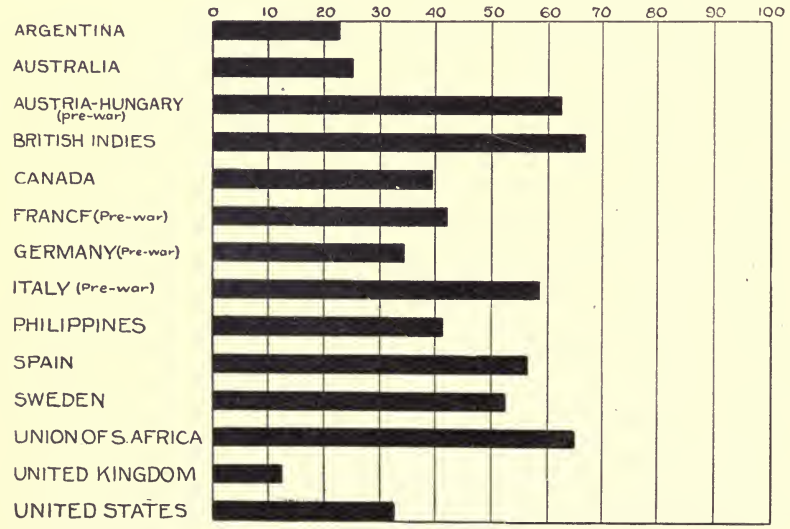
The 1910 census gave 10,582,000 males as actively engaged in agriculture in the United States, 35.2 per cent of males engaged in all occupations. Females engaged in agriculture to the number of 1,806,584, 22.4 per cent of all women engaged in all occupations. This makes a total of 12,388,623 people engaged in agriculture, or 32.5 per cent of the people engaged in all occupations. Compare with the following countries (percentages from most recent figures obtainable):

Of the total population there are engaged in agriculture in Argentina 23.6 per cent, Australia 25.6 per cent, Austria-Hungary (pre-war) 63 per cent, British India 67.1 per cent, Canada 39.9 per cent, France (pre-war) 42.4 per cent, Germany (pre-war) 34.6 per cent, Italy (pre-war) 58.8 per cent, the Philippines 41.3 per cent, Spain 56.9 per cent, Sweden 52.8 per cent, Union of South Africa 65.1 per cent, United Kingdom 12.4 per cent.

With these figures in mind, and not forgetting the possibilities of intensive cultivation, which, as shown in the following statistics for several commodities, is practiced abroad so effectively as greatly to increase the yield per acre over United States figures, it is obvious that the limit of agricultural development in this country is so far distant that no man can foresee it. Eliminating all possibilities of increase of tillable area through irrigation, and all possibilities of increase of yield through modern scientific development, not this nor many future generations will see the ability of this land to support its population from an agricultural standpoint reached or passed.

GROWTH

The more than double doubling of farm products within one generation is a sure indication of the wonderful growth of the United States. Pages might be written about it, but could do no more than show what the table on page 38 expresses so vividly.



PER CENT OF POPULATION ENGAGED IN AGRICULTURAL PURSUITS

STEAM PLOW

STACKS OF HEADED GRAIN READY TO BE THRESHED

THRESHING EXPERIMENTAL GRAIN FROM CEREAL PROJECT, HAYS, KANSAS

WOODED PASTURE

EFFECT OF THE WAR

The war has had a tremendous effect upon production of United States staples and their export. The wheat production 1915 was the record for the United States, greater than any previous year by 128,000,000 bushels. Exports of wheat and wheat flour jumped from $142,000,000 in 1914 to $428,000,000 in 1915, a proportion which is considerably less than the jump in corn, which with corn meal was from $7,000,000 to over $39,000,000. Neither crop, however, compares in its export jump with oats. In 1914 the United States exported $1,000,000 worth and in 1915 $57,000,000 worth. It is hardly necessary to chronicle, because every one knows that the immense increase in exports of food stuffs as well as manufactures changed the status of the balance of trade for this country. It is also well known how the export of cotton decreased, the figures being from $610,000,000 to $376,000,000 in a year.

But in spite of the loss in cotton the war has had on the whole a very beneficial effect upon American agriculture. Exports of wheat and wheat flour represented over 37 per cent of the 1914 crop, while the usual exportation is less than 20 per cent. Farmers received an average of 79 cents per bushel for the 1913 wheat crop and $1.01 for the crop of 1914, an increase of 32 cents per bushel or an aggregate gain of approximately $196,000,000.

PRODUCTION OF SPECIAL CROPS

Because of the vastness of the subject it is impossible to do more than indicate here the value and extent of a few of the principal crops of the United States. Unless otherwise stated, statistics given are for 1915 and prices are values at the farm.

Because the United States produces more wheat than any other country, and a great deal more than we use, many people think wheat is our principal crop. Such is not the case, corn being the principal crop of the United States.

Corn

One hundred and eight million three hundred and twenty-one thousand acres in the United States are under cultivation for the corn crop of 3,054,535,000 bushels. As the production for all of North America, including Canada, United States and Mexico; Argentina, Chile and Uruguay in South America; Austria-Hungary, Bulgaria, France, Italy, Portugal and Roumania, Russia, Servia, Spain, India (both British and native states), Japan, the Philippine Islands, Algeria, Egypt and Union of South Africa, Australia and New Zealand, was but 3,864,279,000 bushels in 1914, it is easily understood why the United States is the greatest corn producing country in the world. Argentina, with 10,386,000 acres under corn cultivation, is next in productive ability, but her total crop for 1915 was but 338,000,235 bushels.

PRODUCTION OF CORN IN THE UNITED STATES 1849-1910

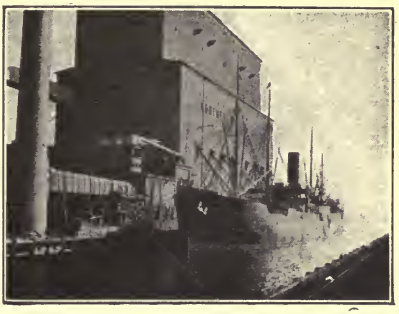
Year	Acreage	Average yield per acre	Production	Average farm price per bushel	Farm Value
	Acres	Bush.	Bushels	Cents	Dollars
1849.....	.....	....	592,071,000	....	.....
1859.....	.....	....	838,793,000	....	.....
1869.....	.....	....	760,945,000	....	.....
1879.....	62,369,000	28.1	1,754,592,000	....	.....
1889.....	72,088,000	29.4	2,122,328,000	....	.....
1899.....	94,914,000	28.1	2,666,324,000	....	.....
1909.....	98,383,000	25.9	2,552,190,000	57.9	1,477,223,000
1915.....	108,321,000	28.2	3,054,535,000	57.5	1,755,859,000

Wheat

World production of wheat is 4,216,806,000 bushels. Of this the United States produces 1,011,505,000 bushels, more than is grown even in Russia, the yield of which is estimated to be 833,965,000 bushels. In the United States 59,898,000 acres are under cultivation for wheat, an increase of over 9,000,000 acres in the past two years. A remarkable fact in connection with the world's wheat production is that Germany, which produces but 160,000,000 bushels of wheat in a year, has, by an average of statistics for ten years, a yield of 30.7 bushels to the acre, whereas the average for the same period in the United States is but 14.8 bushels. Hungary has an average of 18.1 bushels, France 20.1 and the United Kingdom 33.4 bushels. Either land abroad is more productive or methods of farming are more intensive; nevertheless the United States easily leads the world in producing the raw material for the staff of life.

On a basis of prices as on December 1st, the value of this wheat crop is $930,302,000. Wheat is produced in every State in the Union, although Massachusetts, New Hampshire, Rhode Island, Connecticut, Florida and Louisiana produce but little. North Dakota is the greatest wheat producing Sate, yielding 151,970,000 bushels, followed by Kansas with 106,538,000 bushels.

It is interesting to note that the average yield per acre in bushels



TAKING ON A CARGO OF WHEAT

WORLD'S WHEAT PRODUCING AREAS

WORLD'S PRODUCTION OF RICE & OATS

increased in 1915 to 16.9 bushels per acre, which is considerably greater than the smallest year (1911) yield average of 12½ bushels per acre. The 1915 yield per acre was almost 2 bushels an acre greater than the average for the 10 years from 1906 to 1916, which was exactly 15 bushels to the acre for the whole United States. It is also interesting and a little puzzling to learn that the greatest yield of wheat per acre comes from Vermont, not known as a wheat producing State, but the few wheat farms of which give an average of 30 bushels to the acre. The poorest wheat producing State in yield per acre is Tennessee with 10½, followed by South Carolina with 10.8 bushels per acre.

Oats

Forty million seven hundred and eighty thousand acres of farm land are under cultivation for oats, producing 1,540,362,000 bushels. The world's production is estimated to be in excess of 4,700,000,000 bushels. Russia produces the second largest amount with 1,006,983,000 bushels, followed by Germany with 650,000,000 bushels. The United States falls far below other countries in the average yield of oats per acre. The average yield in the United States from 1905 to 1914 was 29.5 bushels per acre. In the same period Germany produced 54, Hungary 31.5, France 31.1 and the United Kingdom 43.5 bushels of oats per acre. The total value of the oats produced in the United States in 1915 was $555,569,000.

Barley

Unspectacular, because comparatively little known, is the barley crop, yet the United States has 7,395,000 acres devoted to its production, resulting in 237,009,000 bushels. Barley is much more largely grown and highly thought of abroad than here. World production is 1,542,972,000 bushels, of which Russia produces 475,109,000 bushels, almost double that of the United States. The value of the

United States barley crop is $122,499,000.

Rye

Forty-nine million one hundred and ninety thousand bushels of rye, valued at $41,295,000, grew on 2,856,000 acres, a small fraction of the world's production of 1,711,158,000 bushels. Any farm product in the United States worth less than $50,000,000 for the year is to be considered among the comparatively unimportant products.

Buckwheat

Similarly buckwheat, of which 806,000 acres produce 15,769,000 bushels at a value of $12,408,000, comes among the unimportant crops, yet buckwheat, used as it is largely for a breakfast food, is increasing in popularity in the United States. The value of the product ten years ago was but $8,565,000; twenty years ago it was $6,936,000.

Potatoes

Although corn and wheat lead the agricultural products of the United States, potatoes are among the most commercially important. They afford one of the most nutritious and one of the cheapest foods for the table of rich and poor alike. A failure in the potato crop means disaster. Three million seven hundred and sixty-one thousand acres are devoted in the United States exclusively to the production of potatoes. The production is 359,103,000 bushels, a large increase in the past ten years, the 1905 figures being 260,741,000 bushels. The average farm price per bushel is 61.6 cents, or a total value for the whole crop of $221,104,000. Potatoes are among the most universally grown crops in the United States, every State producing enough to make a variation in the statistics if omitted. Even little Rhode Island has over 5,000 acres devoted to the production of the popular "spud," growing 550,000 bushels. Maine and New York are the two largest producers of potatoes, both accounting for 22,010,000 bushels. The value of the New York crop is about $3,000,000 greater than

WORLD'S PRODUCTION OF MAIZE & BARLEY

that of the Maine crop, although Maine produces its crop from 142,000 acres, whereas New York has 355,000 acres engaged in potato production.

The production of potatoes abroad makes a curious comparison with that of the United States. The world production is 5,714,188,000 bushels (1913 figures). Of this enormous total Austria-Hungary alone produced 627,728,000, one third more bushels than produced and used by the United States in 1915. Germany by it he sustains his working tools, the farm animals, and feeds the stock, which is in itself a crop. In the United States 50,872,000 acres produce hay with an average yield of 1.68 tons per acre. This makes the total production 85,225,000 tons, a weight as impossible to realize as it is to grasp the fact that it is valued at $912,320,000. The combined navies of the world have not a tonnage equal to the United States hay crop. A fleet of two thousand boats, each the size and dimensions

WORLD'S PRODUCTION OF POTATOES & SAGO

produces 1,674,377,000 bushels of potatoes, whereas the total for European Russia is 1,269,696,000 bushels. It is amusing to note that of the 279,121,000 bushels produced by the United Kingdom in 1914, Scotland grew 40,270,000, Wales 5,445,000, England 104,504,000 and Ireland the balance of 128,642,000 bushels of Irish "praties."

Hay

To the farmer few crops are of more importance than hay, because of the ill-fated "Lusitania," would not weigh as much, nor are there wheeled vehicles enough in the United States, outside of railroad equipment, to load a year's crop upon it and haul it to market in one day's time. New York and Pennsylvania are the two leading States, the former growing 5,850,000 tons on 4,500,000 acres, valued at $91,845,000, and the latter growing 4,340,000 tons on 3,100,000 acres, valued at $67,704,000. Rhode Island produced the least amount of hay,

getting 71,000 tons from 57,000 acres.

Cotton

No crops are more important to manufacturing than cotton. Most agricultural products either feed the world or the animals which, working for farmers, assist in feeding the world. Cotton and wool, however, are agricultural products which are used for clothing, and cotton, much more than wool, is of enormous importance in the arts. The war conditions hurt the cotton industry in this country to a very large extent, but a recovery is now under way, and even though the war continues it will in time grow nearly to normal. Under usual conditions over 65 per cent of the cotton crop of the United States is exported, 53 per cent of our total agricultural exports consisting of cotton. Consequently anything which hurts its exportation strikes a blow at the whole cotton industry of the United States, much as if over half of our wheat crop or half of our farm animals should suddenly be wiped out of existence.

On the 1st of August, 1914, cotton sold at an average of 12.4 cents a pound. By November it had declined to 6.3 cents a pound, a reduction of nearly one half. The whole cotton crop of 1913 averaged to its producers 12½ cents per pound, whereas that of 1914 averaged but 7.3 cents, a decline of over 40 per cent. In other words, over $283,000,000, or one-third of the estimated value of the cotton crop, was lost on account of the war, and this in spite of the fact that production in 1914 was almost 2,000,000 bales greater than in 1913.

It is difficult for the uninitiated to appreciate the extent to which the South depends upon its cotton product. Cotton and cotton seed represent almost two thirds of the value of all crops produced in Georgia and Mississippi. Cotton represents 63 per cent of the value of al, crops produced in Texas, 60 per cent of those produced in Alabama and 53 per cent of those produced in Arkansas.

The industrial depression caused by the shrinkage in cotton values was severe, but by June, 1915, the total shipments for the year were within 8 per cent of the preceding year. Nevertheless the value has shrunk, in spite of crop recovery, over 38 per cent. As a result of this, plus the foreign demand for grain, the acreage under cultivation for wheat, barley, oats and other cereals needed abroad has greatly increased, while cotton planters now plant a much smaller acreage than in prewar times. The estimate for the cotton crop for the fiscal year is

MECHANICAL COTTON PICKER

less than 11,000,000 bales, which, compared with the production of 16,134,000 bales in 1914 and with an average yearly production in the preceding five years of 13,033,000 bales, is rather small. The decrease results from a reduction of about 15 per cent in the acreage planted in cotton and a 20 per cent poorer yield.

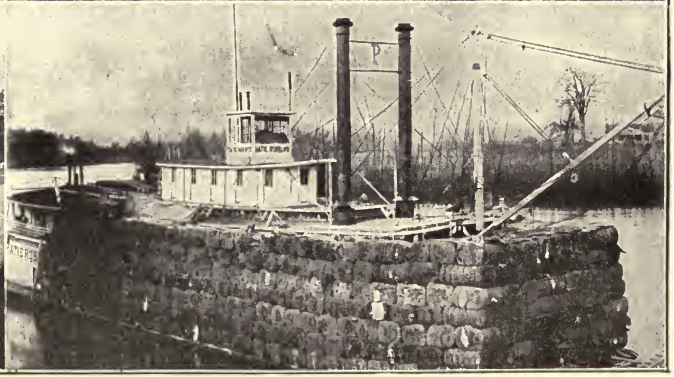
Few countries give official statistics for the production of cotton, so that to state any figure and call it the world's production of cotton is impossible with any degree of accuracy. British India produced

WORLD'S PRODUCTION OF COTTON & RUBBER

PICKING COTTON

BALING COTTON

STREET SCENE—WAGONS LOADED WITH COTTON BALES



RIVER STEAMER LOADED WITH BALED COTTON

4,238,494 bales of cotton in 1914 against over 16,000,000 for the United States for the same year. The total for Russia in 1914 was 1,177,995 bales and Egypt is credited with 1,450,000 bales during the same period. Statistics of 1910 give the world's production of 22,433,269 bales of cotton, but are frankly inaccurate and are only for those comparatively few countries from which figures are available. Normally the United States has under cultivation in the neighborhood of 36,000,000 acres of cotton and could normally expect this year to produce a much larger quantity than will be picked under the abnormal conditions.

Texas is the largest producer of cotton among the States, accounting for 3,175,000 bales of 500 pounds each. Georgia is next with 1,900,000 bales, followed by South Carolina with 1,160,000 bales. Virginia has the smallest cotton crop, marketing but 16,000 bales.

Tobacco

In the year 1849 the United States produced 199,753,000 pounds of tobacco. In 1915 our production was 1,060,587,000 pounds, a crop valued at $96,041,000 at the farms of 1,368,400 acres which produced it. Kentucky is the leading tobacco State, with 356,400,000 pounds yearly, followed by North Carolina with 198,400,000 and Virgina with 144,375,000 pounds.

Tobacco is one of the agricultural products which we both export and import, the imports, however, falling far short of the exports. In 1914 our exports were 348,346,091 pounds (more than 40 per cent of the crop) and our imports 45,764,728 pounds. The reason for any imports, of course, is the fact that there are so many varieties of tobacco, and not all kinds grow well, or in sufficient quantity, in the climate of our Southern States. Both exports and imports given above are of the unmanufactured tobacco. World figures for tobacco production are not available with any degree of accuracy since 1911, when the total was 2,566,202,000 pounds, not quite three times the production of the United States alone in that year.

Flax

One million three hundred and sixty-seven thousand acres produce 13,845,000 bushels of flax and flax seed, of which the average farm price per bushel is $1.739. The total value is thus $24,080,000. North Dakota leads all flax producing States with an acreage of 660,000 and a production of 6,534,000 bushels, and as the value of this North Dakota flax was over $11,000,000 this one State has nearly half the flax industry of the United States.

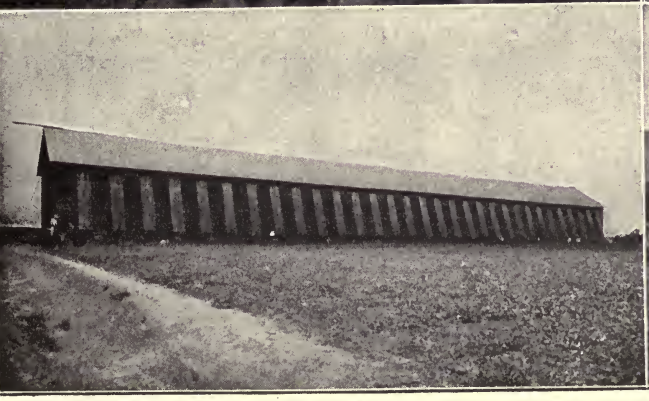
Rice

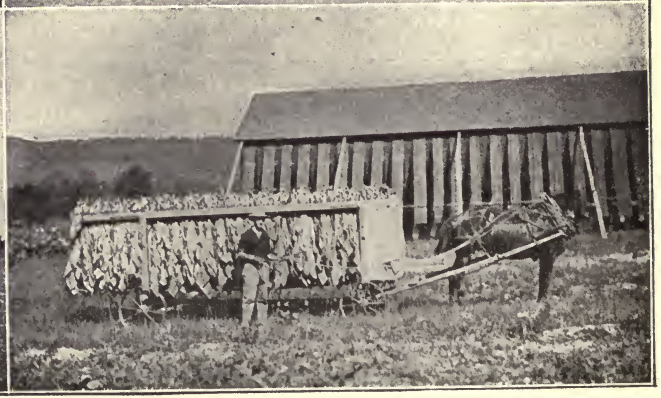
Rice is not one of the great crops of the United States and yet an acreage of 803,000 is devoted to its growing. Twenty-eight million nine hundred and forty-seven bushels of rice, with a value of $26,212,000, is the rice industry's contribution to our agricultural wealth. For comparison with statistics of other countries it is necessary to express production in pounds. In 1914 we grew 656,917,000 pounds, while Italy produced 741,262,000 pounds and British India 62,638,912,000 pounds. Japan grew 17,827,247,000 pounds and our own Philippine Islands 1,403,516,000 pounds. Just what a small proportion of the total rice crop of the world is ours is shown by the world's figures for 1913, 100,700,000,000 pounds of rice.

Apples

Apples are among the important fruit crops of the United States. Of three bushel barrels there were 76,670,000 grown, at an average price of 74.6 cents per bushel at the farm. The principal apple producing State is New York, with 8,528,000 barrels, followed by Missouri with 6,287,000 barrels and Pennsylvania with 5,085,000 barrels. There are more than 35 varieties of apples extensively grown in the United States, of which the most

WORLD'S PRODUCTION OF TOBACCO





CUTTING TOBACCO
TOBACCO BARN

METHOD OF HANGING TOBACCO ON POLE
HARVESTING TOBACCO, CONNECTICUT VALLEY

TOBACCO ARRANGED ON LITTERS TO BE TAKEN TO STRINGERS
SHADE CLOTH TOBACCO FIELD

LOAD OF PRIMED TOBACCO
CULTIVATOR USED IN TOBACCO FIELD UNDER SHADE

WORLD'S PRODUCTION OF WINE

popular is the Baldwin, with 13.4 per cent of the total crop; followed by Ben Davis, 13.3 per cent; Northern Spy, 6.1 per cent; Winesap, 5.1 per cent; Rhode Island Greening, 4.7 per cent, and Jonathan, with 3.6 per cent of the total crop. The total production of apples in the United States was considerably less in 1915 than in 1914, the difference being over 8,000,000 barrels, which is almost exactly the difference between the production in 1914 and 1915 in New York State.

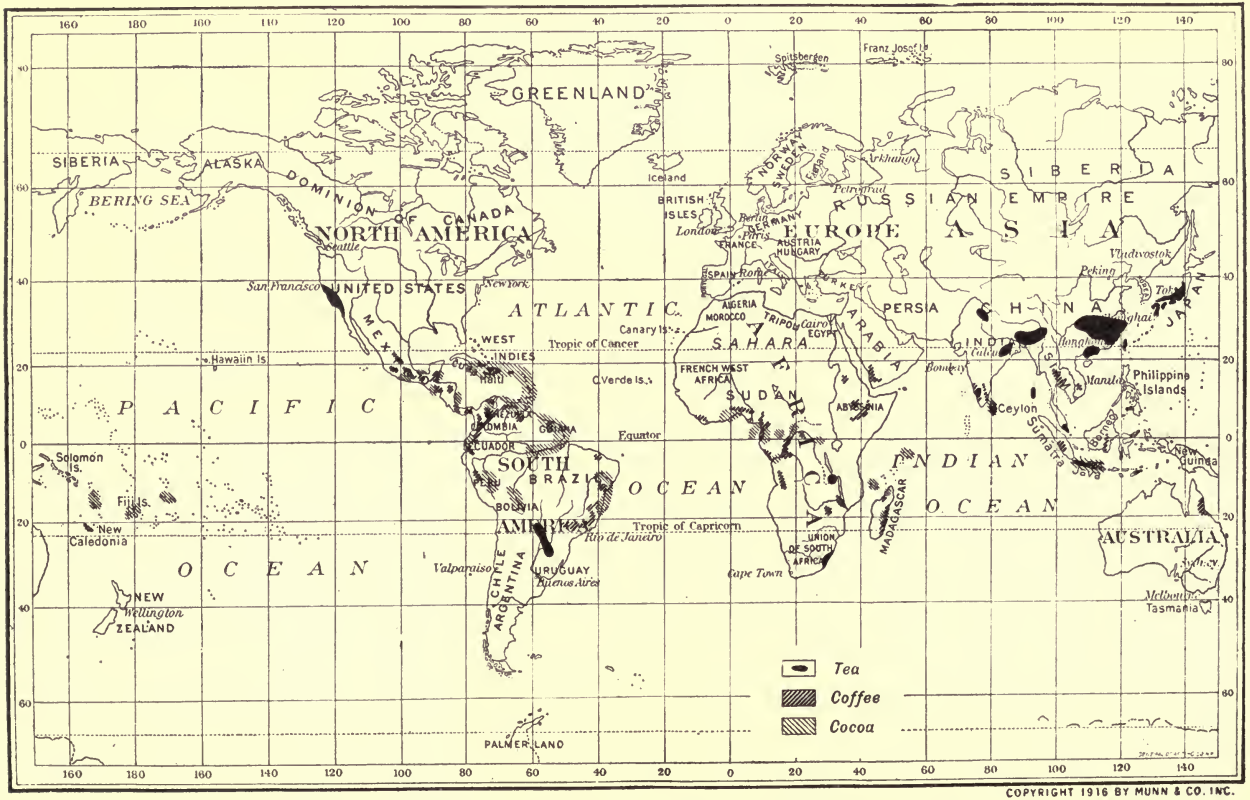
Peaches

United States orchards produce 64,218,000 bushels of peaches. The farm price per bushel averages 81.1 cents, making the total peach crop of the United States $52,080,798 in value. California leads in the peach production with 9,768,000 bushels, followed by Arkansas with 5,940,000 and Georgia with 5,330,000 bushels.

Hops

According to 1913 statistics the principal hop producing countries of the world grew 173,937,000 pounds of hops. Of this quantity the United States produced 62,898,000 pounds. The following year, 1914, the hop production in the United States dropped to 43,415,000 pounds. As might be expected, Germany, if not the leader, is very close to the front in the production of this herb, being responsible (1914) for 55,227,000 pounds. The United Kingdom produced 1,500,000 pounds more than

TOMATO PLANTS TRAINED ON TWINE TRELLISES



WORLD'S PRODUCTION OF TEA, COFFEE & COCOA

Germany. No 1915 figures for hops are as yet available.

Beans

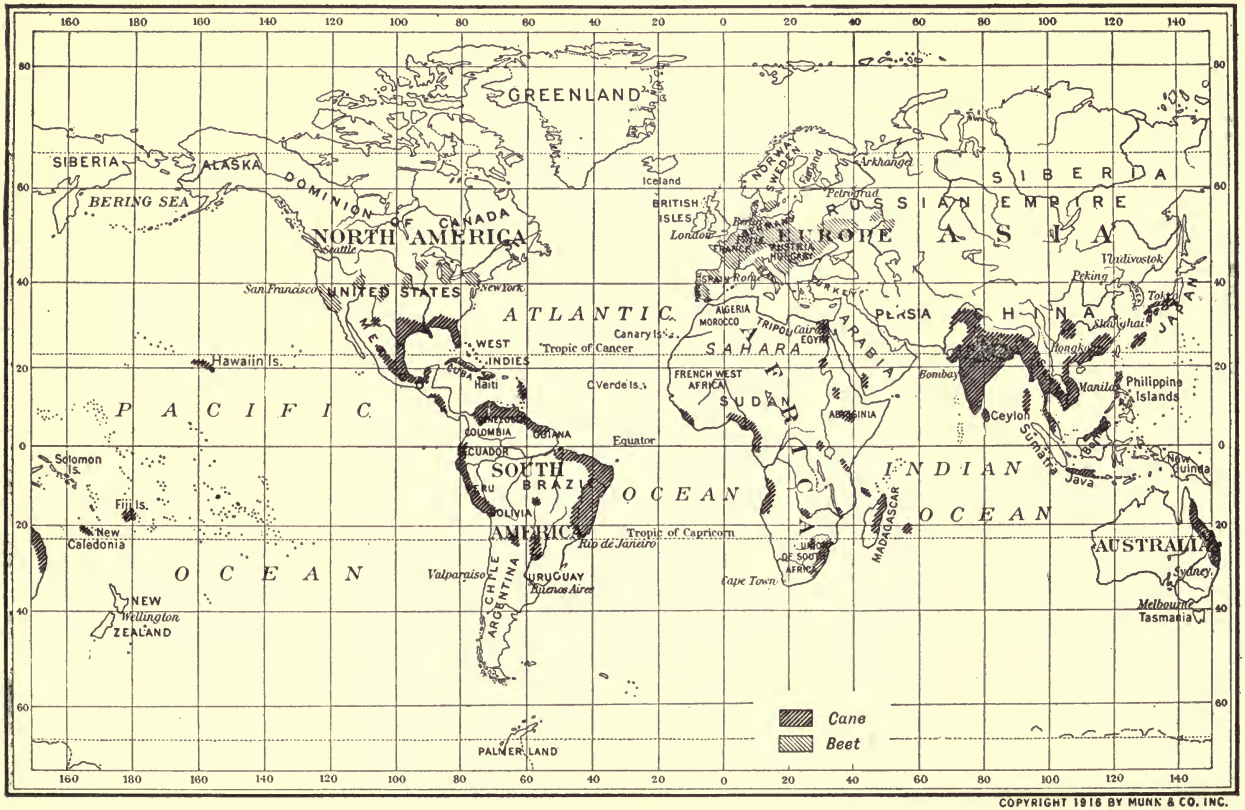
Beans, a universal food, are grown all over the world. The world's bean crop is enormous, but available statistics are too scattering, even in the largest bean producing countries, to have any great degree of accuracy. The United States has no official figures for beans later than 1912, which were issued by the census office. In that year 11,145,000 bushels of beans were grown. Austria-Hungary beats this production by almost 50 per cent, growing 20,445,000 bushels; France produces 9,354,000 bushels (1914), Italy 16,997,000 (1914) and European Russia 12,717,000 (1913) bushels. The price of beans in the United States in 1915 fluctuated between $2.15 and $6.40 per bushel.

Peas

One million three hundred and two thousand acres in 1912 was the area devoted to the production of peas in the United States. There are no later official figures. The 1912 production was 7,110,000 bushels, comparing not at all with European Russia, which in the same year produced 32,128,000 bushels, or even with Spain, which produced 9,885,000 bushels, although the Spanish figures for peas include chick peas, lentils and vetches.

FIELD OF SUGAR BEETS

SOUTHDOWNS IN PASTURE



WORLD'S PRODUCTION OF SUGAR

Sugar

Sugar beets and sugar cane form a very important industry in the United States, there being 67 factories engaged in the production of beet sugar from beets. These factories produce 862,800 short tons of sugar, chiefly refined. Six hundred and twenty-four thousand acres are devoted to the production of sugar beets, each acre yielding an average of 10.4 short tons of beets, so that 6,462,000 tons were utilized. Sugar beets average $5.54 per ton. The principal refineries are located in California (11), Colorado (14), Idaho (4), Michigan (15), Ohio (4) and Utah (8).

The United States is by no means the world leader in beet sugar, Austria-Hungary producing over 1,700,000 and Germany 2,755,750 short tons. In the United States, according to 1914 figures, a total of 483,400 acres were devoted to growing sugar beets, whereas in all Europe the total devoted to beets was 5,502,200 acres (1913). It is, therefore, not surprising to note that Europe's production of sugar from beets in 1913 was 61,774,400 tons against the five and one half million of the United States. Louisiana is the cane sugar center. In 1914, the last year for which statistics are available, 149 factories produced 242,700 short tons of sugar from 3,199,000 short tons of sugar cane. The average yield of cane per acre in Louisiana was 15 tons, a loss of two tons from the unusually luxuriant production in 1913, 17 tons to the acre.

SMUDGE POTS

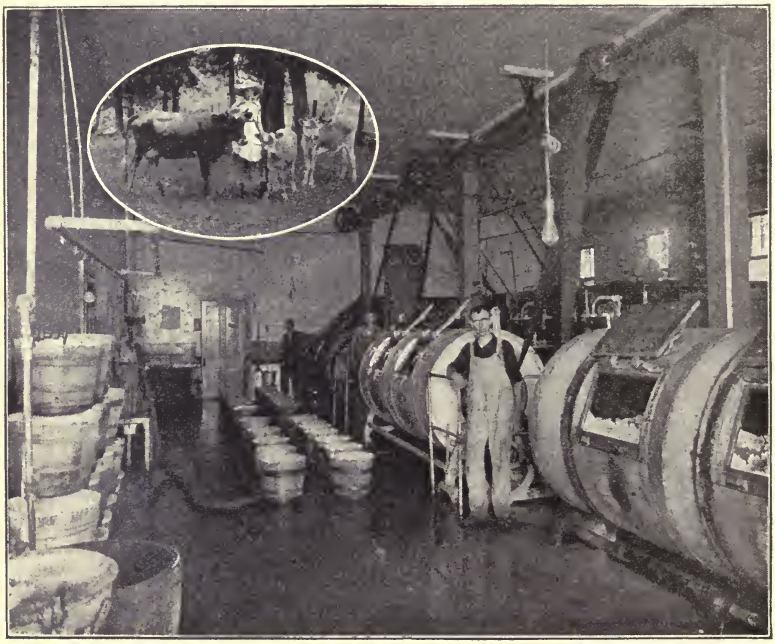
The Hawaiian Islands have 46 factories, which average 183 days operation in the year. In 1914 the Hawaiian factories produced 612,000 short tons of sugar from the harvest of 112,700 acres. The average yield per acre was 43 short tons, a total

WORLD'S CATTLE RAISING REGIONS

WORLD'S SHEEP RAISING REGIONS

CATTLE STATISTICS

Jan. 1	Milch Cows			Other Cattle		
	Number	Price per head Jan. 1	Farm value Jan. 1	Number	Price per head Jan. 1	Farm value Jan. 1
1867....	8,349,000	$28.74	$239,947,000	11,731,000	$15.79	$185,254,000
1876....	11,085,000	25.61	283,879,000	16,785,000	17.00	285,387,000
1886....	14,235,000	27.40	389,986,000	31,275,000	21.17	661,956,000
1896....	16,138,000	22.55	363,956,000	32,085,000	15.86	508,928,000
1906....	19,794,000	29.44	582,789,000	47,068,000	15.85	746,172,000
1916....	21,988,000	53.90	1,185,119,000	39,453,000	33.49	1,321,135,000



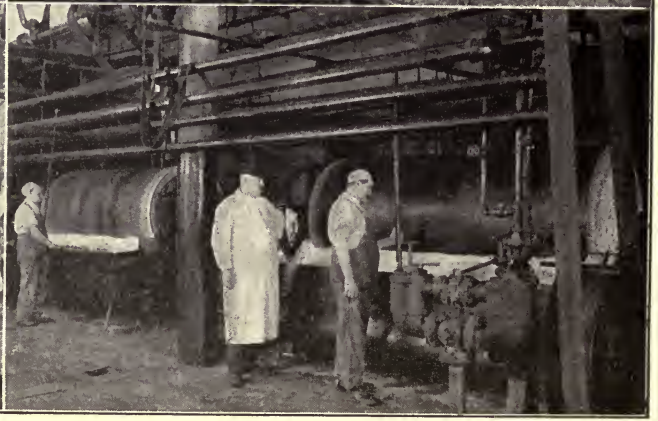
CHURNING BUTTER IN A CO-OPERATIVE CREAMERY—INSERT SHOWS A MODERN MILK-MAID

production of 4,900,000 short tons of cane. The Hawaiian cane is extremely rich, requiring but a single short ton of cane to produce 250 pounds of sugar, an average yield of 10,861 pounds of sugar per acre of cane.

LIVE STOCK

Horses and Mules

Increase in numbers of horses and mules on United States farms has fully kept pace with the increase in population. The census of 1870 showed 7,145,370 horses and 1,125,-



DRAFTING YARD, SHOWING FLAT TOP CANOPY UNDER WHICH THE MAIN CUTTING CHUTE IS LOCATED

SHEEP CARCASSES HANGING IN CHILLING ROOM, OR COOLER

INSPECTING SALT MEAT IN A BIG PRODUCING HOUSE

RENDERING LARD IN A PACKING HOUSE

415 mules in the United States. The estimated number for 1916, based on the best available statistics, is 21,166,000 horses and 4,565,000 mules. The average value of a farm horse in 1870 was $67.43. To-day it is $101.60. The average price of a farm mule in 1870 was $90.42. To-day it is $113.87. The total value of all horses in 1870 was $556,251,000. To-day it is $2,150,468,000. Mules were valued in 1870 at $106,654,000. To-day their value runs in excess of $519,820,000.

The average price of any commodity for the whole United States is seldom equal to the market price as paid in any of the great markets. For instance, the average price per head for horses in the Chicago Horse Market in 1914 was $208 for a drafter, $483 for a carriage team, $169 for drivers, $160 for general horses, $184 for saddle horses, and so on. These figures represent a considerable increase in recent years, Chicago prices for 1901 being $157 for drafters, $400 for carriage team, $137 for drivers, $102 for horses for general work and $147 for saddle horses.

Iowa farms possess more horses than any other State, having 1,584,000. Illinois comes next with 1,452,000, then Texas with 1,180,000, with Kansas, Montana and Nebraska

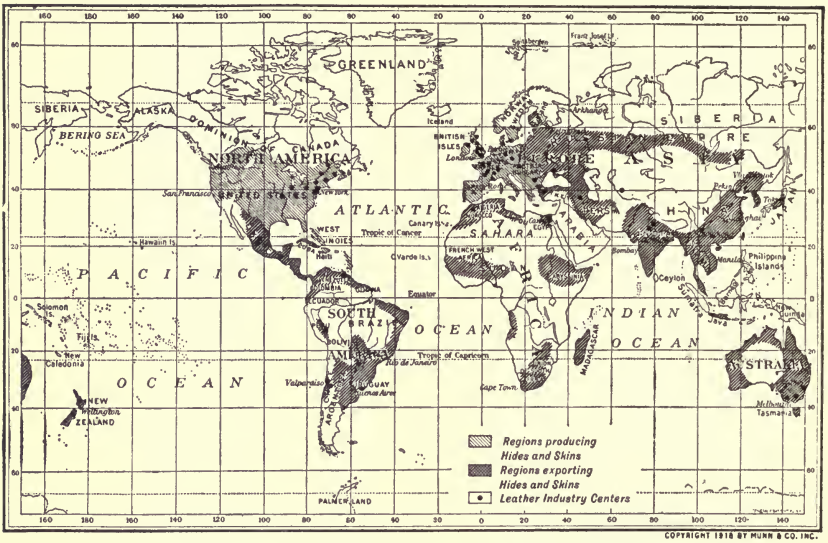
FARM PRODUCT CARRIED AS FREIGHT IN THE UNITED STATES, 1912–1914

Product	Year ending June 30		
	1912	1913	1914
	Short tons	Short tons	Short tons
Animal matter:			
Animals, live	14,147,000	15,042,000	14,811,000
Packing-house products—			
Dressed meats	2,346,000	2,407,000	2,283,000
Hides (including leather)	1,139,000	1,121,000	1,081,000
Other packing-house products	2,360,000	2,345,000	2,375,000
Total packing-house products	5,845,000	5,873,000	5,739,000
Poultry (including game and fish)	768,000	847,000	915,000
Wool	407,000	398,000	409,000
Other animal matter	3,807,000	4,286,000	5,264,000
Total animal matter	24,974,000	26,446,000	27,138,000
Vegetable matter:			
Cotton	4,953,000	3,942,000	4,141,000
Fruits and vegetables	12,880,000	16,099,000	16,795,000
Grain and grain products—			
Grain	39,299,000	50,945,000	46,015,000
Grain products—			
Flour	8,629,000	9,523,000	9,697,000
Other grain products	7,081,000	7,830,000	7,824,000
Total grain and grain products	55,009,000	68,298,000	63,536,000
Hay	6,828,000	7,145,000	7,319,000
Sugar	3,233,000	3,599,000	3,926,000
Tobacco	982,000	1,091,000	1,071,000
Other vegetable matter	10,125,000	9,493,000	9,338,000
Total vegetable matter	94,010,000	109,667,000	106,126,000
Total farm products	118,984,000	136,113,000	133,264,000

A Gentle Shower Under Perfect Control
625 Bushels of Potatoes to the Acre, Which Crop Brings a High Price Because of Its Priority

Gathering Lettuce on a 40-Acre "Patch." Four Crops Are Matured and Ready for Market When Best Prices Prevail
Bleaching Celery by Using Paper Instead of Dirt

TURNING OUT CROPS ON SCHEDULE TIME BY MODERN INTENSIVE CULTIVATION BY OVERHEAD IRRIGATION



WORLD'S PRODUCTIONS OF HIDES AND SKINS

WORLD'S DAIRY PRODUCTION

next, all having more than 1,000,000. Texas easily leads in the possession of mules with 753,000. Montana follows with 329,000 and Georgia has 309,000.

Texas, of course, is the great cattle State. Nineteen sixteen figures give the Lone Star ranges 1,119,000 milch cows and 5,428,000 other cattle. Iowa follows with 1,391,000 milch cows and 2,737,000 other cattle. Illinois, Wisconsin and Minnesota are all among the greatest cattle States, the stock on farms outnumbering even the great herds in more strictly cattle States, such as Oklahoma is popularly supposed to be with its 1,638,000 head.

Sheep

Sheep, like cattle, are valued not only for their meat but for wool and hide. United States sheep total 49,162,000. The average price per head is $5.17, making the total farm value $254,348,000 for all the sheep in the United States. Wyoming, the great sheep State, leads with a herd of 4,338,000, followed by Montana with 3,941,000, New Mexico with 3,440,000, Idaho with 3,102,000 and Ohio with 3,067,000. While this enormous herd roams the Western plains and Eastern farms 36,000,698 fleeces are marketed, the average weight of which is 6.78 pounds, the total product in the raw state being 228,777,000 pounds of wool.

Swine

Farms of the United States possess a herd of 68,047,000 swine, the average price of which is $8.40 per head, or a total farm value of $571,890,000 for pork alone. Iowa is the great pork State of the Union, averaging in 1916, 9,069,000 hogs and pigs of all kinds, followed by Missouri, Illinois, Nebraska and Indiana, all over 4,000,000 each.

RÉSUMÉ

The space at hand forbids an extension of this brief survey of a part of the agricultural wealth of the United States. Perhaps no one set of figures can show in more succinct manner the extent of the farming activities of this country than the table on page 62 of our agricultural products carried on railroads and therefore marketed.

FISHERIES OF THE WORLD

CHAPTER IV.

THE FISH WE EAT

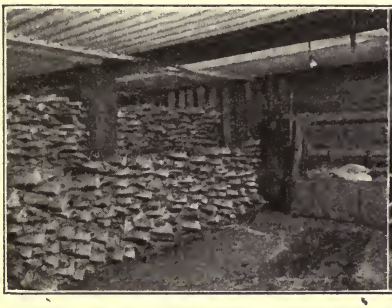
By RALSTON MOORE

THE last report of the United States Census dealing with the fishing industries of the United States is that of 1908. The next report will be in 1918. The 1908 figures, given below, are therefore only authoritative in giving a comparison between the various piscatorial products of our waters and cannot be accepted too literally even there, as the past eight years have seen many changes in some of the industries.

ture, but detailed figures of certain other fish industries are available through the work of the Bureau of Fisheries.

The greatest fishing industry of the Atlantic Coast is conducted by the fleets centering at Boston and Gloucester. Three hundred and ninety-three vessels were in these fleets in 1914, including sail, gasoline and steam vessels.

There were 7,598 trips made by these vessels, landing at both ports



FROZEN HALIBUT IN STORE AT SEATTLE

CLEANING THE FISH ON A STEAM HALIBUT FISHERMAN

The most important sea food industry in the United States is unquestionably the oyster industry. No product of the water has a greater nutritive value and none is more readily caught and sold than this shell fish. No statistics, however, later than those of the census of 1908 are available for oyster cul-

162,589,220 pounds of fish, valued at $4,395,030. This shows a decrease in the number of trips from the previous year of 1,231, an increase in the catch of 372,434 pounds, but a decrease in the value of $587,987.

HADDOCK

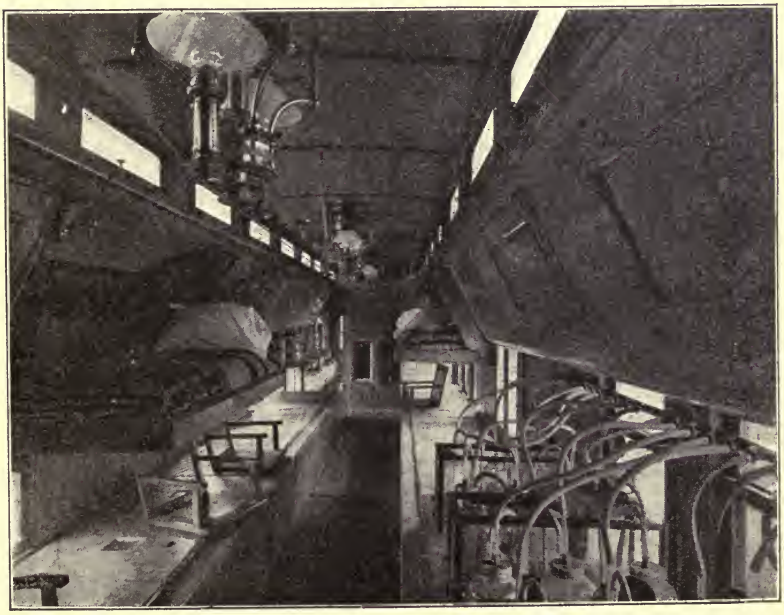
In 1914, 57,754,128 pounds of had-

PRODUCTS OF THE FISHERIES OF THE UNITED STATES: 1908.

Species.	Pounds.	Dollars.
Alewives	89,978,000	589,000
Black bass	3,313,000	255,000
Bluefish	7,647,000	506,000
Bream or Sunfish	4,738,000	120,000
Buffalo fish	16,729,000	498,000
Butterfish	6,855,000	237,000
Carp, German	42,763,000	1,135,000
Catfish	17,817,000	785,000
Cod	109,453,000	2,903,000
Croaker	8,143,000	226,000
Cusk	6,344,000	105,000
Drum, fresh-water	6,532,000	154,000
Drum, salt-water	4,576,000	164,000
Eels	3,358,000	203,000
Flounders	23,346,000	588,000
Haddock	59,987,000	1,308,000
Hake	34,340,000	464,000
Halibut	34,441,000	1,562,000
Herring	125,050,000	796,000
Herring (lake)	41,118,000	989,000
Mackerel	12,103,000	848,000
Menhaden	394,776,000	893,000
Mullet	33,703,000	908,000
Perch, white	2,412,000	137,000
Perch, yellow	7,898,000	258,000
Pike and Pickerel	2,959,000	174,000
Pike perch	15,247,000	580,000
Pollock	29,462,000	402,000
Pompano	570,000	71,000
Rockfish	2,454,000	66,000
Salmon	90,417,000	3,347,000
Scup	8,414,000	290,000
Sea bass	6,352,000	284,000
Shad	27,641,000	2,113,000
Smelt	4,340,000	174,000
Snapper, red	13,498,000	636,000
Spanish mackerel	3,806,000	194,000
Squeteague	49,869,000	1,776,000
Striped bass	3,657,000	314,000
Sturgeon	2,072,000	157,000
Suckers	8,555,000	215,000
Swordfish	2,714,000	198,000
Trout	12,024,000	800,000
Whitefish	7,722,000	524,000
Lobsters	15,279,000	1,931,000
Shrimp	14,374,000	390,000
Clams, hard	7,805,000	1,317,000
Clams, soft	8,654,000	553,000
Oysters	233,309,000	15,713,000
Mussel shells	81,869,000	392,000
Pearls and slugs	.....	300,000
Terrapin	268,000	80,000
Turtles	1,088,000	40,000
Sponges	622,000	545,000
Alligator hides	372,000	61,000
Mink skins	22,000	89,000
Muskrat skins	149,000	136,000
Otter skins	7,600	30,000
Whalebone	63,000	215,000
Scallops	2,414,000	317,000
Oil, sperm	3,391,000	252,000
Oil, whale	573,000	30,000
Irish moss	772,000	26,000

The total quantity and value of the products of the fisheries of the United States including the items mentioned above and all other fish products was 1,893,454,000 pounds, valued at $54,031,000. No later figures are available at time of publication. In many cases there was an increase, in other cases a decrease.

FISH EGG CAR OF THE BUREAU OF FISHERIES



INTERIOR OF FISH COMMISSION CAR, WITH BERTH LET DOWN

dock were landed, valued at $1,381,-156. This was an increase in the number of pounds landed during the previous year by over four million, but a decrease of $100,000 in value.

POLLOCK

Pollock fish, which are caught with purse seines, yielded a less number of pounds and value in 1914 than 1913, the 1914 catch being 12,-454,723 pounds, valued at $199,736.

SWORDFISH

Swordfish were less plentiful in 1914 than several years previously. American fishing vessels landed at Boston and Gloucester in 1914 1,499,844 pounds of fresh swordfish, valued at $177,669.

COD

Cod is among the most important fish; it is marketed both fresh and salt, and as cod and scrod, the latter being from one to two and one half pounds in weight. The total catch of all kinds landed at Boston and Gloucester was, in 1914, fresh cod, 36,079,873 pounds, valued at $917,-908; salted cod, 11,449,757 pounds, valued at $411,508.

HERRING

Newfoundland herring landed at Boston, Gloucester and other New England ports during the season of 1914 and the first part of 1915 amounted approximately to 2,570,-352 pounds of fresh frozen fish, and 49,166 barrels, amounting to 11,071,-584 pounds, of salted herring.

HALIBUT

Halibut valued at $246,000 for 3,063,000 pounds, and salted halibut to the amount of 316,000 pounds, valued at $30,000, was packed during the year.

CUSK

Cusk yielded 5,747,053 pounds

A ROUGH MORNING ON THE HALIBUT BANKS. LANDING A SMALL CATCH

fresh, valued at $99,000, and salted, 111,937 pounds, valued at $3,200.

HAKE

Hake was caught to the amount of 7,404,335 pounds, valued at $146,-030, and salted to the amount of 222,033 pounds, valued at $4,218.

LOBSTERS

Lobsters are caught from Lewes, Del., to the tip of Maine, and provide 12,267,017 pounds of sea food annually (1913), valued at $2,394,-822 for 8,832,281 lobsters. The industry shows the peculiar and anomalous condition of a steadily decreasing output and a steadily increasing profit to those engaged. In twenty-four years' time the yearly catch has decreased by more than 18,000,000 pounds, or 60 per cent, while the fisherman's receipts have increased by a million and a half dollars, or 178 per cent. In 1880 the lobster brought an average of .024 cents a pound. In 1913 lobsters averaged .191 cents per pound, nearly ten times as much as in 1880 and two and a half times as much as in 1900.

ALASKAN

The 1914 season saw the Alaska fishing industry at its height of value. It afforded employment to 21,200 persons and included the investment of $37,000,000. The total value of the products of the Alaskan fishers is estimated at $21,243,000, an advance of over $5,500,000 over 1913, due largely to an unusual abundance of red salmon and the higher prices commanded by canned salmon.

SEAL

The fur seal service reports from the Pribilof Islands a satisfactory

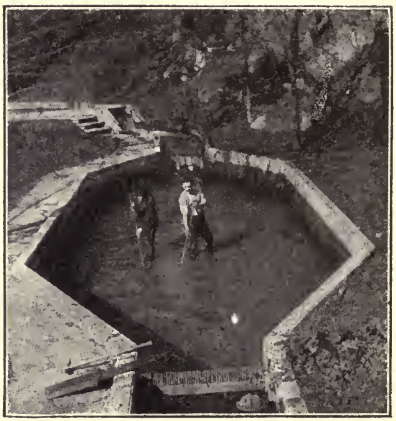
FISH CULTURAL STATION, BOZEMAN, MONTANA

condition of the seal herd. A complete census of the seals shows 294,687, an increase of nearly 27,000 animals over the year 1913. The 1915 census has not yet been completed but indicates an increase of 60,000 animals over 1914.

MUSSEL

The Bureau of Fisheries has been conducting a general canvass of fresh-water mussel fishing, which has been in progress for several years on the streams inland. The canvass covered in 1914 included tributaries to the Great Lakes and the Ohio and Mississippi Rivers. Three thousand nine hundred and fifty-two persons were engaged in taking mussels in the streams under consideration and in preparing them for the market. The mussel fisheries had an output of 23,317 tons of shells, valued at $382,210, and yielded pearls worth $164,261. The shells are used in the manufacture of pearl buttons.

SPAWNING TROUT AT NEOSHO, MO., HATCHERY



FISH CULTURAL STATION, WYTHEVILLE, VA.

BUREAU OF FISHERIES

The Bureau of Fisheries of the Department of Commerce is charged with supervision of propagation and distribution of food and game fishes and scientific investigations into all matters pertaining to fish. In 1914 the enormous quantity of 4,288,757,800 fish and ova were distributed. The greater proportion of this, of course, was egg and not fish, but fingerling, yearling and adult fish numbered over 58,000,000, an increase of 150 per cent over 1914. Of this number, salmon, trout and bass contributed the larger part.

Perhaps nothing in the work of the bureau is more spectacular than its development of a new fish industry—the catching and marketing of tile fish. This edible and nutritive fish was practically unknown in the market prior to October of 1915. Beginning with November, 1915, and up to August, 1916, 6,938,000 pounds of tile fish have been taken and marketed for $255,000. So rapidly did the fish impress consumers with its value that the July, 1916, catch was over 1400 per cent greater than that of the previous November.

Fish cultural work was conducted in thirty-two States and the territory of Alaska. Distributions oc-

curred in every State and Territory of the Union. The greater part of the output is planted in public waters, either on the initiative of the Fish Commission or on the recommendation of State authority, although fishes adapted for ponds, small lakes and minor interior waters are usually consigned on individual application.

Fish cultural operations were conducted during the year at fifty permanent hatcheries and seventy-six sub-hatcheries, auxiliaries and egg-collecting stations. These various stations and sub-stations are located along the Atlantic rivers for salmons, trout, white perch and yellow perch; the Pacific rivers for salmons and steelhead trout; on the Great Lakes for whitefish, cisco. lake trout and pike perch; on various interior waters for bass. sunfish, carpies, trout, and on the Atlantic Coast for cod, haddock, pollock, flounder and lobster.

An important branch of the Bureau of Fisheries operations is in the rescue of young food fishes from lakes and bayous formed by the overflow of the Mississippi and Illinois Rivers and their tributaries. During 1915 operations of this character yielded 8,357,000 fish, which is approximately 90 per cent of the food fishes which would otherwise have perished through drought or "air drowning" when the overflow dried up, or from cold later in the year if not rescued.

The Bureau of Fisheries has six railroad cars especially arranged for the transportation of live fish. During the year ending June 30, 1915, the distribution of fish, eggs, etc., by the bureau amounted to 536,260,143 eggs, 3,694,281,699 fry and 58,215,692 fingerlings, yearlings and adults. These went to Fish Commissions in twenty-eight different States, to waters needing stock. from the controllers of which requests had been made to the bureau, and to private persons asking for fish for streams, lakes or ponds. While in special instances some fish or eggs are sent by special messenger, by far the greater part was sent out by means of the bureau's special fish and egg transportation cars.

The Bureau of Fisheries has been investigating and encouraging wherever possible the establishment of the home fish ponds and in every way possible places its accumulated experience at the disposal of persons interested in the establishment

THESE MEN WITH MILK CANS ACT SUSPICIOUSLY, BUT THEY ARE ONLY DEPOSITING FISH IN A STREAM

of fish ponds for the purpose of supplying fish for the table. It is impossible, adequately, to convey an idea of the scope of operations of the Bureau of Fisheries in the short space available here Those interested should communicate with the Commissioner of Fisheries, Bureau of Fisheries, Department of Commerce, Washington, D. C.

A FOREST RANGER AT HIS FIRE LOOKOUT STATION IN THE TOP OF A YELLOW PINE. MT. SHASTA IN THE BACKGROUND. A TELEPHONE AT THE FOOT OF THE TREE CONNECTS WITH THE SUPERVISOR'S OFFICE

CHAPTER V.

FORESTS AND FORESTRY

TIMBER SUPPLY

By RICHARDSON DAVENPORT

TIMBER standing in the United States amounts to nearly 2,900,000,000,000 board feet, of which three fourths (about 2,200,000,000,000 board feet) is privately owned and 21 per cent (600,000,000,000) is conserved in national forests. The remaining 4 per cent is otherwise publicly owned by States or municipalities.

Fire accounts for the annual destruction of 12,000,000,000 board feet, and waste as much more. Many saws waste as much as they cut, and stumps, slashing and slabs account for a tremendous loss. It is probable, although not computable accurately, that fires and waste use more lumber than is cut yearly, a statement borne out by the fact that the original stand of timber in the United States is calculated to have been 5,200,000,000,000 feet, covering 800,000,000 acres. Nearly half the country's timber is in the Pacific Northwest, a fourth of it is in the Southern Pine region, and the balance in the Lake region and scattered in the Eastern States.

Most of the national forests are in the mountains of the West, following in general the Rocky Mountains and Pacific Coast ranges from Washington, Idaho and Montana to southern California. Arizona and New Mexico. A few are in Arkansas, Florida, Nebraska, Michigan, Minnesota, Alaska and Porto Rico. States which have set aside forest reserves of their own are California,

Sowing Tree Seeds

The Trees of Future Forests

THE GOVERNMENT HAS 34,000,000 LITTLE TREES WHICH WILL BE USED TO PLANT DENUDED AREAS ON THE NATIONAL FORESTS

Connecticut, Indiana, Maryland, Massachusetts, Michigan, Minnesota, New Hampshire, New Jersey, New York, Pennsylvania, South Dakota, Vermont and Wisconsin.

SHIFT IN LUMBER PRODUCTION

A careful comparison of computed production for 1915 as against reported production for 1914 reveals changes which lumber cutting is

1915 LUMBER CUT BY SPECIES, WITH VALUE

Kind of Wood	Probable Total Board Feet	Value, per M Board Feet
Yellow Pine	14,700,000,000	$12.50
Douglas fir	4,431,249,000	10.50
Oak	2,970,000,000	19.00
White pine	2,700,000,000	18.00
Hemlock	2,275,000,000	13.00
Spruce	1,400,000,000	16.50
Western yellow pine	1,293,985,000	14.50
Cypress	1,100,000,000	20.00
Maple	900,000,000	15.00
Red gum	655,000,000	12.50
Chestnut	490,000,000	16.00
Yellow poplar	464,000,000	22.50
Redwood	420,294,000	13.50
Cedar	420,000,000	15.50
Birch	415,000,000	16.50
Larch	375,000,000	11.00
Beech	360,000,000	14.00
Basswood	260,000,000	19.00
Elm	210,000,000	17.00
Ash	190,000,000	22.50
Cottonwood	180,000,000	17.50
Tupelo	170,000,000	12.00
White fir	125,048,000	11.00
Sugar pine	117,701,000	17.50 to 18.50
Balsam fir	100,000,000	14.00
Hickory	100,000,000	23.50
Walnut	90,000,000	
Lodgepole pine	26,486,000	13.00
Sycamore	25,000,000	14.00
All other kinds	49,531,000	
Total	37,013,294,000	

ANNUAL CUT

Reliable but not absolutely accurate figures of lumber production are furnished by the Forest Service of the United States government. Based on the reports from 16,428 lumber mills, the 1915 cut is estimated to have been 37,013,294,000 board feet, with a possible maximum of 38,000,000,000 board feet. A "board foot" is 12 by 12 by 1 inch. Forty per cent of the cut was Southern yellow pine, three times the amount of Douglas fir, second in quantity cut. But three other woods, oak, white pine and fir, were cut in excess of 2,000,000,000 feet.

ON THE FIRING LINE, FIGHTING A GROUND FIRE

1915 AND 1914 PRODUCTION OF LUMBER BY STATES REPORTED BY MILLS CUTTING 50,000 AND OVER

States	Increase or Decrease Per Cent	1915 Computed Total Production M ft.	1914 Reported Production* M ft.
Washington	+ .1	3,950,000	3,946,189
Louisiana	− 1.4	3,900,000	3,956,434
Mississippi	+ .8	2,300,000	2,280,966
North Carolina	− 6.2	2,090,000	2,227,854
Arkansas	+ .2	1,800,000	1,796,780
Texas	+12.6	1,750,000	1,554,005
Oregon	− 7.0	1,690,000	1,817,875
Alabama	+ .4	1,500,000	1,494,732
Virginia	+ .8	1,500,000	1,488,070
Wisconsin	−13.0	1,210,000	1,391,001
California (incl. Nev.)	−14.3	1,130,000	1,318,065
Florida	+ 3.4	1,110,000	1,073,821
Michigan	− 9.4	1,100,000	1,214,435
Minnesota	−16.2	1,100,000	1,312,230
West Virginia	− 1.7	1,100,000	1,118,480
Maine	+ .7	1,000,000	992,594
Georgia	− 2.6	1,000,000	1,026,191
Pennsylvania	+ 9.9	950,000	864,710
South Carolina	+14.0	800,000	701,540
Tennessee	− 9.6	800,000	885,035
Idaho	+ 1.8	777,000	763,508
Kentucky	− 6.1	560,000	596,392
New Hampshire	+ 3.6	500,000	482,744
New York	− 2.3	475,000	486,195
Ohio	+39.8	400,000	286,063
Missouri	− 5.6	350,000	370,571
Indiana	+17.2	350,000	298,571
Montana	+ 3.2	328,000	317,842
Vermont	+ 4.2	260,000	249,608
Massachusetts	+74.7	250,000	143,094
Oklahoma	+14.7	230,000	200,594
Maryland	+ 1.9	165,000	162,097
Illinois	+66.1	110,000	66,227
Connecticut	+ 9.9	90,000	81,883
Colorado	−22.1	79,500	102,117
Arizona	− 3.5	75,915	78,667
New Mexico	+15.1	65,787	57,167
New Jersey	−17.9	40,000	48,748
Iowa	+205.9	35,000	11,443
Delaware	− 2.0	25,000	25,517
South Dakota	+27.0	23,000	18,744
Wyoming	+46.8	17,400	11,852
Rhode Island	− 5.7	15,000	15,902
Utah	+25.5	10,892	8,680
Kansas and Nebraska	−....	.....**	790
Totals	−.9	37,013,294	37,346,023

* Quinquennial census of manufacturers—custom mills excluded
** Mills reporting cut less than 50,000 each

producing in the location of principal supplies. During the year Washington rose from second place to first in lumber production, Louisiana dropped from first to second place, Oregon fell from fifth place to seventh, Florida climbed from fifteenth place to twelfth and Minnesota dropped from eleventh place to fourteenth.

LOCALITIES OF VARIOUS SPECIES

The principal varieties of lumber and the States in which they grow are listed on page 80, the order of the names of States being according to their rank in growing the particular variety of lumber under which they are classified.

LATHS AND SHINGLES

From the reports of mills and the

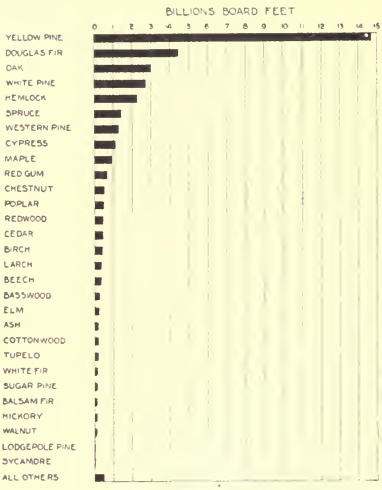
TIMBER REGIONS OF THE WORLD

total number of mills and their capacity, a comparatively accurate figure of total cut can be obtained. But it is not possible accurately to estimate what proportion of the output of unreporting mills may be in lath and shingles. Hence the following figures are confined strictly to reports and are not estimates. As the lath cut increased slightly and the shingle cut decreased decidedly since 1912, the last previous year for which lath and shingle figures are available, they are given for comparison.

In 1915 mills reporting showed a lath cut of 2,794,301,000 as against 2,719,163,000 in 1912. In 1915 mills reporting showed a shingle cut of 8,483,579,000 against 12,037,685,000 in 1912.

Louisiana produced most laths in 1915, with 433,176,000, forging ahead of Washington, leader in 1912. Washington produced most shingles

1915 TIMBER CUT BY SPECIES



REGULATED VS. UNREGULATED CUTTING

The private lands are stripped, while the adjoining government forests are conserved

in 1915, with a cut of 6,313,335,000, more than fifteen times as many as any other State, but dropping by a billion and a half under its figures for 1912.

BOX MANUFACTURE

The largest users of lumber in the United States, excluding builders and millwrights utilizing lumber for products used in construction work, are the box manufacturers. Statistics for 1912 are the most recent ones available. According to these, 4,547,973,180 board feet are used annually in the production of boxes, crates and other containers. Sixty-nine per cent of this amount is soft wood and 31 hardwood. The total amount in 1912 was 1⅛ per cent of the total cut.

Leading box consumers are manufacturers of oil, packing-house products, canned goods, groceries and tobacco, clothing and dry goods, the manufacturers of hardware, tinware and machines, growers of fruit, berries and vegetables. Crates are used in large quantities by shippers of furniture, hardware, machinery and stone; also for fruit.

CROSSTIES

Railroads made a tremendous demand on the lumber market for crossties and poles. No more recent statistics than those of 1910 are available as to crossties, but in that year nearly 149,000,000 ties were used. Because a tie must be selected for durability, spike-holding power, resistance to mechanical wear and reasonableness of price, there are but few woods which are chosen by railroads. The principal ones and their popularity by both steam and electric roads are shown in the table on page 82.

POLES

Railroads, trolley lines, telephone and telegraph companies consume large quantities of lumber yearly in

LOCALITIES OF VARIOUS SPECIES

Species	States Listed in Order of Rank
Yellow pine	Louisiana, Mississippi, Texas, North Carolina, Alabama, Arkansas, Florida, Virginia, Georgia, South Carolina, Oklahoma
Douglas fir	Washington, Oregon, California, Idaho, Montana
White pine	Minnesota, Idaho, Maine, New Hampshire, Wisconsin, Massachusetts, Michigan
Oak	West Virginia, Kentucky, Tennessee, Arkansas, Virginia, Ohio, Pennsylvania, North Carolina, Missouri, Mississippi, Indiana, Louisiana
Hemlock	Wisconsin, Michigan, Washington, Pennsylvania, West Virginia, New York, Maine, Oregon
Western pine	California, Idaho, Oregon, Washington, Montana, Arizona, New Mexico, Nevada
Spruce	Maine, Washington, New Hampshire, West Virginia, Vermont, Oregon, New York, Minnesota, Massachusetts
Cypress	Louisiana, Florida, Georgia, South Carolina, Arkansas, Mississippi, Missouri
Maple	Michigan, Wisconsin
Redwood	California
Red gum	Arkansas, Mississippi, Louisiana, South Carolina, Missouri, Tennessee, North Carolina, Kentucky
Larch and tamarack	Montana, Idaho, Minnesota, Wisconsin, Michigan, Washington, Oregon
Yellow poplar	West Virginia, Kentucky, Tennessee, Virginia, North Carolina, Ohio
Cedar	Washington, Idaho, California, Oregon
Birch	Wisconsin, Michigan
Sugar pine	California
Basswood	Wisconsin, Michigan
Beech	Michigan, Indiana
Elm	Wisconsin, Michigan
Cottonwood	Arkansas, Mississippi, Louisiana

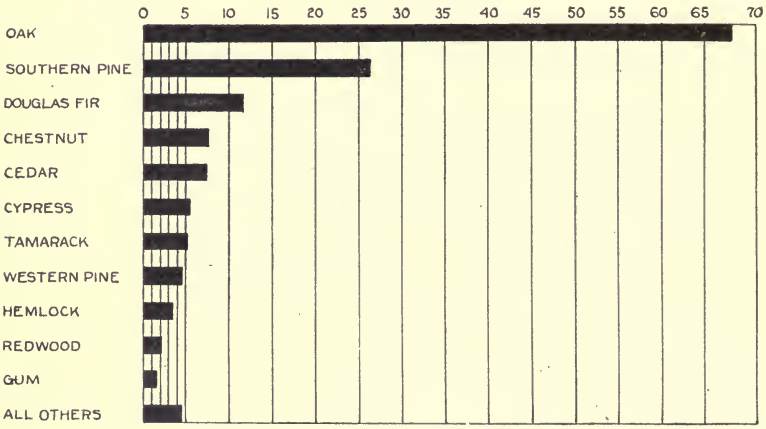
on page 82.

NATURAL FOREST REGIONS OF NORTH AMERICA

CROSSTIES PURCHASED, BY CLASSES OF RAILROADS PURCHASING, AND KINDS OF WOOD

1910

Wood	Total	Purchased by steam railroads	Purchased by electric railroads
All kinds	148,231,000	139,596,000	8,635,000
Oak	68,382,000	65,095,000	3,287,000
Southern pine	26,264,000	25,096,000	1,168,000
Douglas fir	11,629,000	10,919,000	710,000
Chestnut	7,760,000	6,219,000	1,541,000
Cedar	7,305,000	6,637,000	668,000
Cypress	5,396,000	5,187,000	209,000
Tamarack	5,163,000	4,960,000	203,000
Western pine	4,612,000	4,527,000	85,000
Hemlock	3,468,000	3,442,000	26,000
Redwood	2,165,000	1,501,000	664,000
Gum	1,621,000	1,621,000	.....
All other	4,466,000	4,392,000	74,000



KINDS OF WOODS USED FOR RAILROAD CROSSTIES

purchase and use of poles. In 1911, the most recent year for which pole statistics have been gathered, 3,418,020 poles were bought by companies needing them for immediate use. Of this quantity cedar poles were the most popular accounting for over two million, with chestnut, oak, pine and cypress following in the order named. Poles under twenty feet long were bought to the number of 404,728 (largely for rural telegraph and telephone lines); poles between twenty and thirty feet, the most popular size, accounted for 1,861,816 of the total; between thirty and forty feet, 862,219; between forty and fifty feet, 217,000, and over fifty feet, 72,257.

WOOD PRESERVATION

The art of preserving wood has advanced rapidly in recent years and the long threatened wood famine

and the consequent higher prices have led many large users of wood exposed to weather and decay, notably railroads and telegraph and telephone companies, to experiment seriously with processes which would cut down expense by prevention of decay. According to statistics of the American Wood Preservers' Association, gathered in cooperation with the Forest Service, in 1915, 102 wood preserving plants treated 141,858,963 cubic feet of material. The 1914 statistics on wood preservation were based on reports from ninety-four plants and showed a total of 159,582,639 cubic feet treated. Although the figures for 1915 are based on the output of eight more plants than are those for 1914, the amount of wood treated in 1915 was less by 17,723,676 cubic feet, or 10 per cent.

A notable increase, amounting to 1,986,286 cubic feet, was recorded in the amount of construction timber treated during the year. The number of crossties subjected to treatment in 1915 was 37,085,585, a reduction from 1914 figures of 6,761,402, while the quantity of paving material was increased by over 300,000 square yards, or 11 per cent. Less than half as many cross-arms were treated in 1915 as in the previous year, and the quantity of piling and miscellaneous timbers treated fell below that reported in 1914 by 1,766,618 and 200,825 cubic feet, respectively, a decrease of 21 per cent and 14 per cent.

For the treatment of the 141,858,963 cubic feet of material reported in 1915 33,269,604 pounds of zinc chloride and 80,859,442 gallons of creosote were required. In addition 3,205,563 gallons of paving oil and 1,693,544 gallons of miscellaneous liquid preservatives were consumed. In 1914 paving oil was reported separately for the first time and amounted to 9,429,444 gallons. In 1915 the treating plants reported only 3,205,563 gallons of this heavier

LOCATING THE FIRE

A Forest Ranger is using his compass and map to find out where the fire is

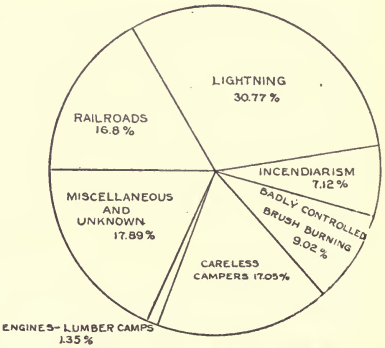
oil, or considerably less than half the 1914 consumption.

NATIONAL FORESTS

The United States holds as national forests 155 separate areas in the United States, aggregating 184,505,602 acres of land, which includes, however, 21,732,332 acres of privately owned land within national forest borders. The net amount owned by the United States government is thus 162,773,280 acres of land.

Contrary to the general impression, this acreage is not a "reserve"—indeed, the name "forest reserve" gave way to "national forest" to correct that impression. The national forests are protected from fire, from over-cutting, from exploitation indeed, but they are made to serve as large a population as possible by permitting their use in every possible way consistent with the preservation of the forests. Wood is cut and sold, mines are worked, water power is developed, sheep and cattle are grazed on these lands as on any others, the difference being that in the national forests all activities are under permits and the forests therefore under protection.

RANGER ON FIRE PATROL DUTY ON THE HIGHEST RIDGE OF THE CABINET NATIONAL FOREST, MONTANA



CAUSES OF FOREST FIRES

The most recent report of the forester shows that the regular appropriation for 1914 for the Forest Service of $5,662,094.13 was not sufficient, and an emergency appropriation had to be made largely on account of a very dry year and the increased necessity for fire protection and fire fighting. The national forests, however, returned to the United States Treasury during the fiscal year the sum of $2,481,469.35. foregone to sell certain lumber at cost; certain free grazing privileges were worth in excess of $120,000, and other privileges are believed to have a market value of $100,000 a year.

During the year 1,093,589,000 board feet of timber was sold. Forty thousand and fifteen free-use timber-cut permits were issued and 30,610 permits given for stock grazing. One million six hundred and twenty-

WATER POWER ON THE NATIONAL FORESTS, JUNE 30, 1915

Permits	Transmission lines only	Power Projects, reservoirs, conduits, and power houses	Estimated average output of stream at minimum discharge
Permits in force on June 30, 1915:			
Rental permits			
Preliminary	..	19	462,039
Final	92	90	728,893
Free permits	16	73	70,628
Total	108	182	1,261,560
Constructed or operating on June 30, 1915:			
Rental permits	84	60	335,435
Free permits	13	48	5,841
Total	97	108	341,276
Under construction June 30, 1915:			
Rental permits	1	15	94,313
Free permits	..	11	1,326
Total	1	26	95,639
Construction not started on June 30, 1915:			
Rental permits	7	34	761,184
Free permits	3	14	63,461
Total	10	48	824,645
Applications received July 1, 1914, to June 30, 1915:			
Rental permits			
Preliminary	..	21	.....
Final	18	13	.....
Free permits	2	13	.....
Total	20	47	.....

These receipts came from timber, $1,175,133.95; grazing, $1,130,495, and special uses, $175,840.40.

A much larger showing could be made were it not for the generous policy of the Government which permits certain privileges free of charge. During the year over $200,000 worth of timber was given away free to settlers; $33,000 of profit was seven thousand three hundred and twenty-one cattle, 96,933 horses, 2,792 hogs, 7,232,276 sheep and 51,409 goats were fed in national forests during the year. Predatory animals, including bears, coyotes, mountain lions, lynxes, wildcats, wolves and wolf pups were destroyed to the number of 3,843, the number indicating only the kill by forest

officers in connection with their work.

Water power permits are shown in the table on page 85.

FIRES

Fires in national forests are guarded against with every possible care, but during the year 6,605 fires occurred. Of these, 3,253 burned less than a quarter of an acre before being extinguished, 1,807 burned less than ten acres, 988 burned less than $100 worth though more than ten acres in extent, 458 fires did damage from $100 to $1,000 and 99 did damage in excess of ten acres and $1,000.

A strict census of fire causes shows 16.8 per cent caused by railroads, 30.77 per cent by lightning, 7.12 per cent by incendiarism, 9.02 per cent by badly controlled brush-burning, 17.05 per cent by careless campers, 1.35 per cent by stationary steam engines—sawmills, donkey engines, etc.—and the balance of 17.89 per cent miscellaneous and unknown causes.

The fires burned in 1914 225,979 timber acres. The open area affected was 153,686 acres, accounting for a loss of timber burned or damaged of 339,430,000 board feet. The loss of money is estimated to be $307,303 for the destroyed timber; reproduction destroyed, $192,408, and forage loss, $2,803. The service expended in fire fighting, outside of salaries of regular officers, $685,790.

NOTE.—It is impossible to give here minute details of all the activities of the Forest Service. Seekers for more detailed information can readily obtain it by writing to the Forest Service, U. S. Department of Agriculture, Washington, D. C.

CHAPTER VI.

RECLAMATION SERVICE

By CLAUDE WASHINGTON

IT is not generally understood that the Reclamation Service of the United States is primarily a "home making" service, nor that it does not compete with private enterprise. Such, nevertheless, are the facts. Early irrigation in this country was entirely a matter of cooperative effort or the result of investment by private or corporate capital, and early laws to encourage irrigation of arid lands all contemplated construction financed by other than governmental money.

The increasing difficulty of carrying out large projects led to the passage of the reclamation act, which enlists national funds for the development of projects not feasible by private or State enterprise.

The projects undertaken involved expensive storage works, high diversion dams, difficult tunnels, or long, expensive canal work upon side hills, where large investment was necessary before any water was brought to the land. Many projects discussed in the early days of reclamation work were rejected by the Reclamation Service because deemed within the reach of private investment. Some of those same projects were later taken up by the Government after years of unsuccessful effort to enlist private capital in their construction. Practically all of the projects undertaken by the Reclamation Service had been abandoned after unsuccessful attempts to finance them as private projects, or else were new projects too difficult to attract the attention of promoters.

Remarkable progress, since its beginning in 1902, has been made by the service, and at the present time about 1,500,000 acres are under ditches and crops are being produced yearly on more than a million acres.

1909 Same Spot 1914

UMATILLA IRRIGATION PROJECT, OREGON

The average gross return per acre from these lands annually is about $25. More than 30,000 families have been established in homes of their own. Cities, towns and villages have sprung up in these agricultural communities. Railroads have extended their branches, and a vast region which a few years ago was uninhabited and a desert has been transformed into a prosperous farming country.

The table below shows the extent of the work and the rate of progress during a recent year.

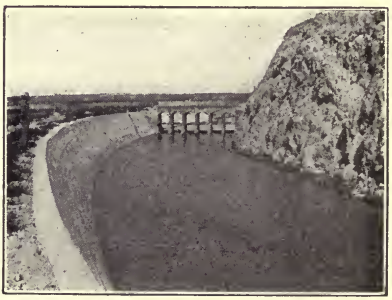
Items	To June 30, 1915		To June 30, 1914		Increase	
	Acres	Farms	Acres	Farms	Acres	Farms
Estimated area 29 projects on completion	3,118,011	60,603	2,921,165	58,323	196,846	2,280
Estimated area to which service was prepared to supply water	1,450,407	29,017	1,343,193	27,115	107,214	1,902
Under contract—						
Water rights	461,632	10,122	416,644	8,559	44,988	1,563
Rental contracts, etc	626,371	13,008	566,843	12,416	59,528	592
Total	1,088,003	23,130	983,487	20,975	104,516	2,155
Reservoir capacity available, acre-feet	6,500,360	.....	5,460,510	.....	1,039,850	.....

A summation of the work to the beginning of the present fiscal year shows that the service has dug 9,592 miles of canals and ditches, and excavated 89 tunnels with an aggregate length of more than 25 miles. Masonry, earth, crib and rock-filled dams have been erected with a total volume of 12,200,000 cubic yards, including the two highest dams in the world. The available reservoir capacity resulting is approximately 6,500,000 acre feet, or sufficient water to cover the States of New Jersey and Delaware to a depth of 12 inches. The service has built 4,622 bridges with a total length of 19 miles. Its culverts number 5,714 and are 36 miles in length. There are now in operation 298 miles of pipe line and 85 miles of flumes. The service has built 784 miles of wagon road, much of it in what was before inaccessible mountain regions; 82 miles of railroad, 2,554 miles of telephone lines, 429 miles of power transmission lines, and 1,068 buildings, such as power houses, pumping stations, offices, residences, barns and storehouses. The excavations of rock and earth in all the work amount to 130,149,368 cubic yards.

The projects now under way or completed embrace approximately 3,000,000 acres of irrigable land, divided into 60,000 farms of from 10 to 160 acres each. During the year 1915 water was available from Government ditches for 1,450,407 acres on 29,017 farms, and the Government was under contract to supply water to 1,088,003 acres.

RESULTS OF RECLAMATION

The object of reclamation is home making on arid lands—the conver-



INTERSTATE CANAL, NORTH PLATTE PROJECT, 150 MILES LONG

"FAT HEN" IS AN APACHE AND HARD WORKMAN

neering problems involved are those of settlement and successful utilization of the irrigation system and water supply by the farmers. Without successful agricultural development a project may be a failure, regardless of the perfection of the engineering work. The sufficiency of the water supply and successful operation of the irrigation system are only incidental to the ultimate object sought by the Government as well as the irrigator and the success of the undertaking is inseparably connected with that of the water user.

IRRIGATION AND CROP RESULTS ON GOVERNMENT RECLAMATION PROJECTS, 1914*

Project	Irrigable acreage	Irrigated acreage	Cropped acreage	Value of Crops	
				Total	Per acre cropped
Salt River	187,112	173,030	169,719	$4,039,079	$23.80
Yuma	60,000	25,207	22,568	709,469	31.43
Orland	14,300	7,354	6,540	176,331	26.99
Uncompahgre Valley	52,338	33,873	33,091	870,381	26.30
Boise	207,000	.....	.....	.....	.....
Farms reported	.....	64,767	58,064	1,033,447	17.80
Farms not reported	.....	18,823	16,868	300,140	17.80
Minidoka	117,090	.....	.....	.....	.....
Gravity unit	.....	45,730	39,138	661,796	16.91
South side pumping unit	.....	35,788	33,512	558,059	16.65
Huntley	28,808	17,068	17,068	454,583	26.63
Milk River	13,440	2,201	2,163	34,618	16.00
Sun River	16,346	6,613	6,561	106,594	16.25
Lower Yellowstone	36,250	5,743	5,621	96,707	17.20
North Platte	91,504	60,532	59,536	890,202	14.95
Truckee-Carson	52,039	39,516	39,285	441,018	11.23
Carlsbad	20,261	12,690	10,731	237,663	22.15
Hondo	1,224	1,224	1,172	21,458	18.31
Rio Grande	40,000	28,442	27,302	1,160,720	42.51
North Dakota pumping	12,239	1,056	1,045	36,440	34.87
Umatilla	17,000	5,102	3,013	88,614	29.41
Klamath	38,000	24,440	24,440	347,344	14.22
Belle Fourche	68,852	37,454	36,709	461,188	12.56
Okanogan	10,099	7,740	3,180	104,575	32.88
Yakima:	.....	.....	.....	.....	58.02
Sunnyside unit	81,807	64,052	49,273	2,858,845	29.60
Tieton unit	34,000	20,600	15,920	472,480	15.01
Shoshone	41,166	22,226	20,905	313,826	.....
Total	1,240,875	761,271	703,424	16,475,517	23.50

* Exclusive of projects constructed for the Indian Service.

sion of desert tracts into self-supporting agricultural communities. This object is not obtained by the construction of irrigation works alone, however elaborate or efficient these may be in design and operation. More difficult than the engi-

To show progress in reclamation work it is necessary to show the results obtained by the farmer as well as those of the engineer. Reclamation is measured not in engineering units, but in homes and agricultural values.

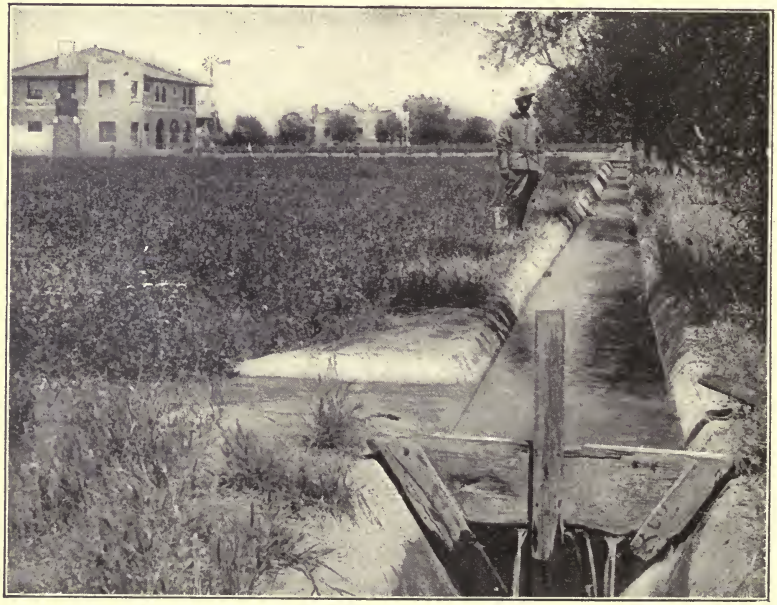
NUMBER AND SIZE OF FARMS AVAILABLE FOR ENTRY, AUGUST 1, 1916

State	Project	No. of farms	Size of farms	Water right
Idaho	Minidoka	26	40 to 80 acres	$30 per acre
		29	40 acres	$45 per acre*
Montana	Huntley	26	40 acres	$60 per acre*
Montana	Sun River	40	40 to 80 acres	$36 per acre
Nebraska-Wyoming	North Platte	19	40 to 80 acres	$55 per acre
South Dakota	Belle Fourche	59	40 to 80 acres	$40 per acre
Wyoming	Shoshone	56	40 to 80 acres	$50, $51 and $52 per acre
Nevada	Truckee-Carson	112	40 to 80 acres	$60 per acre

* For lands under the Huntley project there is an additional charge of $4.00 per acre for the land, of which $1.00 is payable at the time of entry and the remainder in four equal annual instalments. For information concerning these projects and method of obtaining land under them, or any additional statistics not covered in this brief chapter, write to Statistician, Reclamation Service, Interior Department, Washington, D. C.

The table on page 89, therefore, is even more illuminative of the success of the work than any engineering statistics alone can possibly be.

By no means all available lands embraced in the various projects is taken up, and every effort is being made by the service to see that they are properly and successfully settled. The table above shows the number of farms available for entry, August 1, 1916, the size of the farm units and the cost of water right.



FARM HOUSES ON THE SALT RIVER PROJECT, SHOWING IRRIGATING DITCH FLOODING ALFALFA

POWER DEVELOPMENT

In connection with the construction of irrigation work, particularly of dams on the larger rivers, it has been necessary to develop power. Power plants are operated principally for pumping water for irrigation; incidentally for other purposes, the excess power being sold for domestic or industrial uses, such as lighting, heating, cooking and operation of machinery. Pumping forms the principal use of the electric power development, and there were installed 10,432 horse-power in permanent pumping plants used in 1914, in addition to numerous small drainage installations semi-portable and intermittently used. The cost of raising 1 acre-foot 1 foot ranges from 0.368 cent to 2.10 cents.

The capacity of all the power plants operated by the service was, in 1914, 27,134 kilowatts from 37 units. The water head ranges from 226 feet at the Roosevelt plant to 21 feet at the Arizona Falls plant. The total cost of all the plants was $2,542,159. The output in kilowatt hours is 66,199,624, and the cost per kilowatt hour ranges from 3.82 cents at the North Dakota Williston plant down to 0.111 cent at the Minidoka plant.

The developed power not needed for irrigation pumping is sold to customers for construction, for camp lights and for drainage work and results in a gross income of $249,174 from power sales, which is almost 10 per cent on cost of installation.

But all these figures fade into insignificance when consideration is had of the accompanying table showing available horse-power subject to development but not yet developed.

UNDEVELOPED HORSE-POWER

Project	Name of plant	Head, Feet	Horse power
Arizona-California, Yuma	Drop, California Canal	9	1,000
Arizona-California, Yuma	Araz	25	7,700
California		27	483
Colorado, Grand Valley	Main Canal	44	3,600
Colorado, Uncompahgre			10,000
Idaho, Boise	Arrowrock Dam	63–180	17,000
Idaho, Boise	Drops in canals	20–90	4,800
Idaho-Minidoka	Minidoka Dam	46	10,000
Montana, Flathead (Indian)	Flathead River	60	360,000
Montana, Flathead (Indian)	Revais Creek	1,000	26,000
Montana, Huntley	Main Canal Drop	34	314
Montana-North Dakota, Lower Yellowstone	Lateral KK drop		290
Nevada, Truckee-Carson	Lahontan	120	5,000
Nevada, Truckee-Carson	26-foot drop	26	2,000
New Mexico-Texas, Rio Grande	Elephant Butte Dam	60–190	12,000
Oregon-California, Klamath	Various sites	22–88	9,700
Oregon, Umatilla	Drainage outfall	28	145
Utah, Strawberry Valley	Spanish Fork	125	1,900
Washington, Okanogan	Salmon Creek	441	2,800
Washington, Yakima, Sunnyside Unit	Drops in canal	20–88	1,800
Washington, Yakima, Tieton Unit			3,250
Washington, Wapato			9,000
Total			488,782

FINANCES

At the beginning of a recent fiscal year the service had $1,401,714.67 cash on hand.

During the year this amount was augmented by receipts from various sources to a grand total of $16,446,794.66.

Of the twenty millions authorized by the act of June 25, 1910, eight and one half millions were transferred to the reclamation fund.

BOISE IRRIGATION PROJECT, IDAHO. HIGHEST DAM IN THE WORLD, 351 FEET FROM BED ROCK TO PARAPET, 1,060 FEET LONG ON TOP

Cash expenditures during the fiscal year were $14,213,172.90.

Town-site receipts transferred to the credit of projects were $18,-436.28.

The balance on hand at the close of the fiscal year amounted to $2,215,185.48.

By the processes of the General Land Office and the Treasury Department the receipts from sales of public lands are held in the Treasury from six to nine months before they are placed to the credit of the reclamation fund. Estimated receipts from the sale of public lands

ESTIMATED COST OF CONTEMPLATED WORK ON ALL PROJECTS DURING FISCAL YEAR, 1916

Examination and surveys		$151,680.45
Storage systems		1,695,052.95
Pumping for irrigation		7,500.00
Canal systems		2,548,004.33
Lateral systems		1,900,991.73
Drainage systems		938,624.50
Flood protection		286,175.00
Power systems		77,072.15
Farm units		59,046.10
Permanent improvements and lands		155,683.40
Telephone systems		29,137.00
Operation and maintenance:		
During construction	$1,053,973.41	
Under public notice	838,405.00	
		1,892,378.41
Stores and other operations		692,100.00
Unallotted to features		680,456.65
Total		**$11,113,902.67**

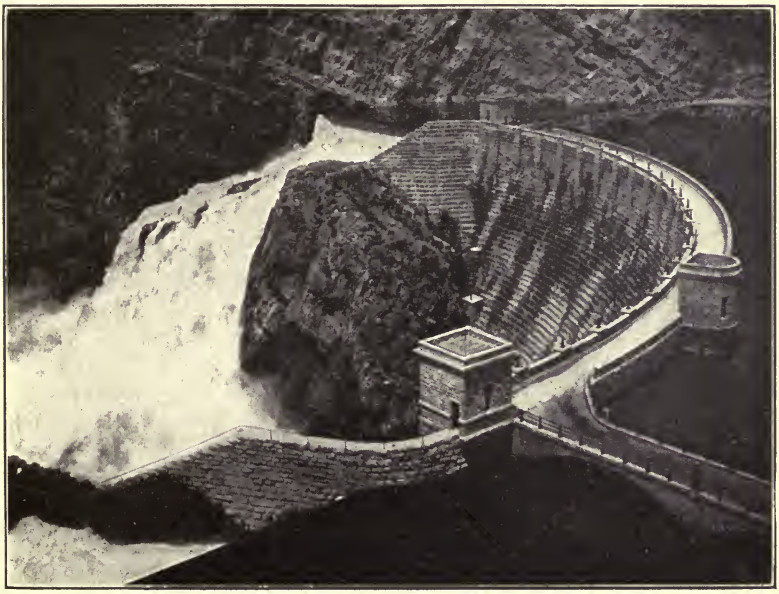
in the hands of the Treasury Department on June 30, 1915, which had not been credited to the reclamation fund amounted to approximately $1,670,000.

The reclamation fund, which comprises the moneys received from the sale of public lands, has now reached the total of $85,914,493.36, and from the sale of town-sites, $280,723.94.

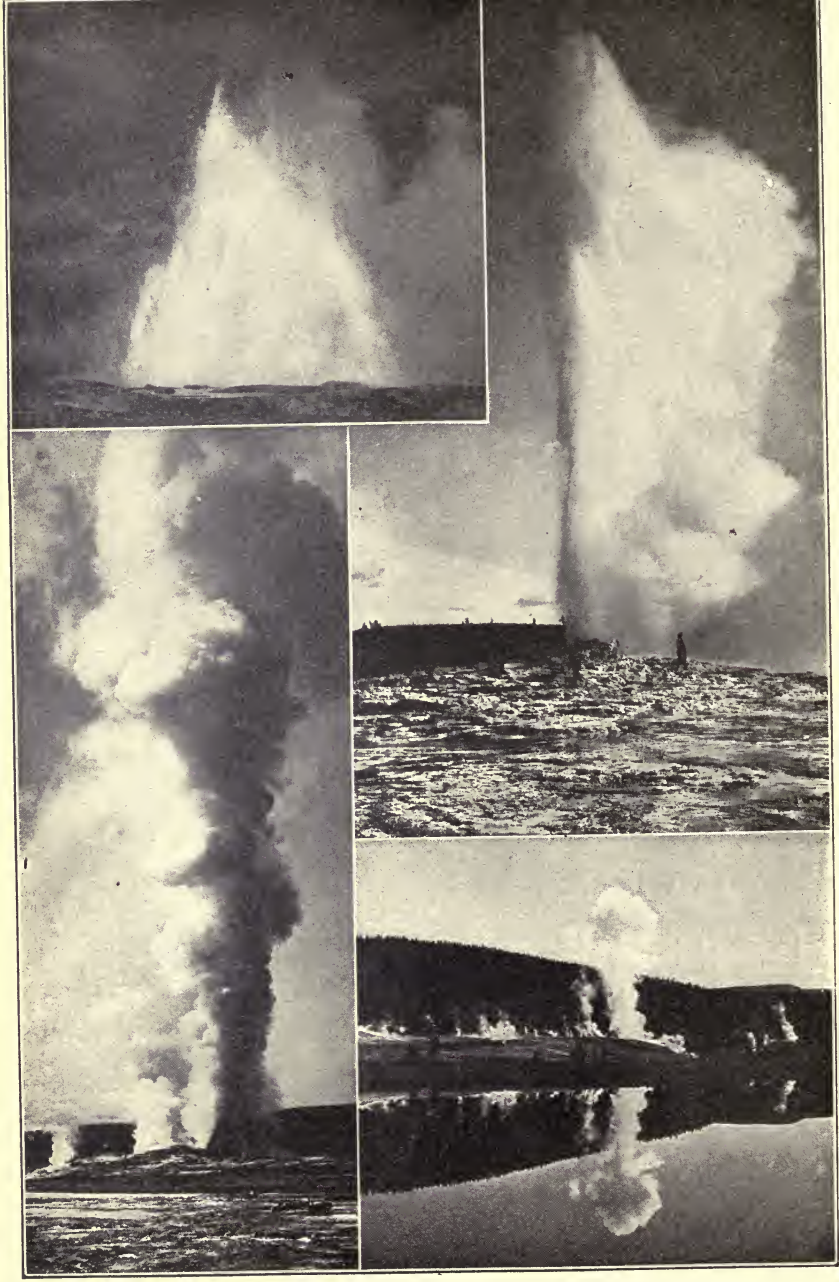
Transfer vouchers, adjusting accounts between the projects for the transfer of the value of services and equipment, amounted to $615,657.58 during the fiscal year 1915. Since the beginning of the service the value of the transfers of supplies, materials, equipment and services between projects has amounted to $5,006,759.37. This system of transfers between projects enables the service to utilize equipment, materials, supplies, etc., to their fullest extent where needed and to charge the cost where the benefit accrues.

ESTIMATED COST OF CONTEMPLATED WORK

It is estimated that during 1916 the sum of $11,113,902.67 will be expended. The table on page 92 gives the tentative distribution of this amount to the various functional features of all projects, including the Blackfeet, Flathead and Fort Peck Indian projects.



ROOSEVELT DAM, ARIZONA



Fountain Geyser
Haynes Photo

Old Faithful
Upper Geyser Basin

CHAPTER VII.

OUR NATIONAL PARKS

HOW many Americans can say offhand how many national parks we have? How many can name the national monuments, or explain the difference between a national park and a national monument?

Very few! And such almost wholesale ignorance is one of many reasons why a Bureau of National Parks, as a part of the Interior Department, has for many years been a vital necessity and why every loyal American, whether he ever sees a national park or not, should rejoice that Congress has finally passed the National Parks Service Bill. This bill, far reaching in import, reads in part as follows:

"Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That there is hereby created in the Department of the Interior a service to be called the National Park Service, which shall be under the charge of a director, who shall be appointed by the Secretary. . . . The service thus established shall promote and regulate the use of the Federal areas known as national parks, monuments and reservations, which purpose is to conserve the scenery and the natural and historic objects and the wild life therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations."

As yet the service is but a name, for the Sixty-fourth Congress has not yet provided an appropriation to form the service. But everything is ready and as soon as the money is available our numerous parks and monuments will have the service of their own they have so long needed.

There are sixteen national parks at present in existence, the first of

Photo by Lindley Eddy

SEQUOIA "GENERAL SHERMAN"
Oldest Tree in the World

National Parks in order of creation	Location	Area in square miles	Distinctive Characteristics
Hot Springs, 1832.....	Middle Arkansas	1½	46 hot springs possessing curative properties. Many hotels and boarding houses. 20 bath houses under public control.
Yellowstone, 1872.....	Northwestern Wyoming	3,348	More geysers than rest of the world. Boiling springs. Mud volcanoes. Petrified forests. Grand Canyon of the Yellowstone, remarkable for gorgeous coloring. Large lakes. Many large streams and waterfalls. Vast wilderness inhabited by deer, elk, bison, moose, antelope, bear, mountain sheep, beaver, etc., constituting greatest wild bird and animal preserve in world. Altitude 6,000 to 11,000 feet. Exceptional trout fishing.
Yosemite, 1890.....	Middle-eastern California	1,125	Valley of world-famed beauty. Lofty cliffs. Waterfalls of extraordinary height. 3 groves of big trees. High Sierra. Large areas of snowy peaks. Waterwheel falls. Good trout fishing.
Sequoia, 1890.....	Middle-eastern California	237	The Big Tree national park. 12,000 sequoia trees over 10 feet in diameter, some 25 to 36 feet in diameter. Towering mountain ranges. Startling precipices. Fine trout fishing.
General Grant, 1890....	Middle-eastern California	4	Created to preserve the celebrated General Grant tree, 35 feet in diameter. 6 miles from Sequoia National Park and under same management.
Casa Grande Ruin, 1892.	Arizona	¾	Prehistoric Indian ruin.
Mount Rainier, 1899....	West-central Washington	324	Largest accessible single peak glacier system. 28 glaciers, some of large size, fifty to five hundred feet thick. Wonderful sub-alpine wild flower fields.
Crater Lake, 1902.....	South-western Oregon	77	Lake of extraordinary blue in crater of extinct volcano, no inlet, no outlet. Sides 1,000 feet high. Interesting lava formations. Fine trout fishing.
Wind Cave, 1903.....	South Dakota	16⅓	Large natural cavern.
Sullys Hill, 1904.....	North Dakota	6¼	Wooded hilly tract on Devil's Lake.
Mesa Verde, 1906.....	South-western Colorado	77	Most notable and best preserved prehistoric cliff dwellings in United States, if not in the world.
Platt, 1906.....	Southern Oklahoma	1½	Many sulphur and other springs possessing medicinal value, under Government regulation.
Glacier, 1910.....	North-western Montana	1,534	Rugged mountain region of Alpine character. 250 glacier-fed lakes. 60 small glaciers. Peaks of unusual shape. Precipices thousands of feet deep. Scenery of marked individuality. Fine trout fishing.
Rocky Mountain, 1915..	North middle-Colorado	358	Heart of the Rockies. Snowy range, peaks 11,000 to 14,250 feet altitude. Remarkable records of glacial period.
Hawaiian, 1916.....	Hawaiian Islands	56	Three volcanoes. Lake of blazing lava. Tropical forests.
Lassen, 1916.....	California	106	Volcano—only one in United States potentially active.

which was Hot Springs, in Arkansas, created in 1832; the most recent, Hawaii National Park and Lassen National Park, being creations of the Sixty-fourth Congress, the bills for the two parks being approved August 1 and 9, 1916, respectively.

The first purposes of the parks are the preservation of scenic beauty and natural wonders for educational and recreation purposes. They make wonders of certain regions free to all the country; indeed, to all the world.

Though Hot Springs was the first of all the parks, it was the creation of the Yellowstone National Park in Wyoming, Montana and Idaho, by the act of March 1, 1872, which really marked the beginning of a policy on the part of Congress of setting aside tracts of land as recreation grounds for all the people.

More and more are we coming to know what we possess in these parks and the war abroad taught us afresh that Europe has nothing in scenery more worth seeing than what we have at home. In the Yellowstone National Park there were 20,250 visitors in 1914, and in 1915 two and one-half times as many, 51,895. Yosemite National Park in California had 33,452 visitors during the 1915 season, whereas in 1914 only 15,145 persons visited the park. Again, in Mount Rainier National Park, Washington, there has been an increase in the number of visitors of over 100 per cent—35,166 in 1915 as against 15,038 in 1914.

But it has been discovered that national parks have a distinct commercial value, as well as an educational and recreative one. The parks produce an ever increasing revenue from tourist traffic, one of the most satisfactory means of revenue a nation can have. The tourist leaves large sums of money but takes away nothing which makes the nation poorer. He goes away with improved health, with a recollection of enjoyment of unequaled wonders of mountain, forest, stream and sky, of vitalizing ozone and stimulating companionship with nature; but of the natural wealth he takes nothing.

The commercial potentialities of tourist traffic are startling. It is estimated that in time of peace Switzerland's annual revenue from tourists is $150,000,000; that of France $600,000,000; little Italy's, $100,000,000. It is claimed that Americans have spent $500,000,000 a year in travel abroad. The pine woods of Maine are estimated to bring a revenue of $40,000,000 each year on account of the visitors they attract, and the orange blossoms of Florida are worth more to her than the products of her soil. Every dollar, therefore, which is spent by the nation on national parks may be considered an investment which is likely to bring in a very satisfactory return upon the money invested.

VISITORS TO NATIONAL PARKS, 1908 TO 1915

Name of Park	1908	1909	1910	1911	1912	1913	1914	1915
Yellowstone National	19,542	32,545	19,575	23,054	22,970	24,929	20,250	51,895
Yosemite National	8,850	13,182	13,619	12,530	10,884	13,735	15,145	33,452
Sequoia National	1,251	854	2,407	3,114	2,923	3,823	4,667	7,647
General Grant National	1,773	798	1,178	2,160	2,240	2,756	3,735	10,523
Mount Rainier National	3,511	5,968	8,000	10,306	8,946	13,501	15,038	35,166
Mesa Verde National	80	165	250	206	230	280	502	663
Crater Lake National	5,275	4,171	5,000	4,500	5,235	6,253	7,096	11,371
Wind Cave National	3,171	3,216	3,387	3,887	3,199	3,988	3,592	2,817
Platt National	26,000	25,000	25,000	30,000	31,000	35,000	30,000	20,000
Sullys Hill National	250	190	190	200	200	300	500	1,000
Hot Springs Reservation	.....	.....	120,000	130,000	135,000	135,000	125,000	115,000
Glacier National	.....	.....	.....	4,000	6,257	12,138	14,168	14,265
Rocky Mountain National	.....	.....	.....	.....	.....	.....	.....	31,000

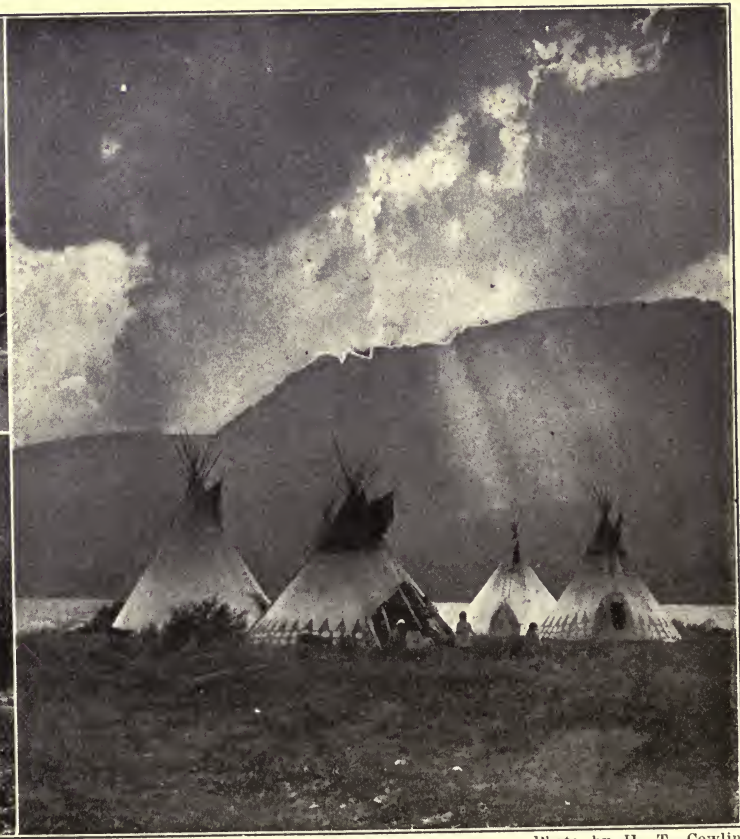


Photo by H. T. Cowling

VISTA IN THE GLACIER PARK
SUNSET IN GLACIER PARK

INDIAN CAMP, GLACIER NATIONAL PARK

THE ECONOMIC VALUE OF TOURIST TRAVEL TO NATIONAL PARKS

Park	Number of visitors (seasons)	Estimated gross receipts by concessionaires (seasons)	Federal appropriations (fiscal years)	Revenues (fiscal years)
Yellowstone:				
1912	22,970	$1,067,161.34	$8,500.00	$16,476.38
1913	24,929	1,186,811.36	8,500.00	21,980.10
1914	20,250	848,688.44	8,500.00	15,439.23
1915	51,895	2,003,072.35	8,500.00	20,307.40
Yosemite:				
1912	10,884	311,444.32	50,000.00	23,855.77
1913	13,735	359,481.45	80,000.00	19,495.83
1914	15,145	334,914.32	125,000.00	23,406.14
1915	33,452	629,929.31	100,000.00	37,019.20
Mount Rainier:				
1912	8,946	56,735.92	5,400.00	5,370.36
1913	13,501	66,942.76	20,000.00	7,301.62
1914	15,038	61,078.08	23,400.00	9,040.10
1915	35,166	138,120.23	51,000.00	12,893.29
Glacier:				
1912	6,257	.....	69,200.00	1,490.94
1913	12,138	161,510.87	75,000.00	4,652.14
1914	14,168	155,716.14	100,000.00	4,010.71
1915	14,265	276,611.54	75,000.00	4,218.51

That this is not a mere speculation is shown in the table above, totaling the economic value of tourist travel to Yellowstone, Yosemite, Glacier and Mount Rainier national parks during the past four years, together with the revenues.

The national parks cover an area of more than 4,700,000 acres. If all were put together it would mean an area of more than 7,300 square miles, practically as large as New Jersey. The Yellowstone National Park, containing more than 3,300 square miles, is as big as many of the independent European principalities that warred with each other for centuries before the genius of Bismarck united them into a great empire.

Such a group of scenic areas, developed and handled after the fashion of Switzerland, would constitute a national economic asset of incalculable value.

It is not for their educational, recreative, or economic value alone, however, that the national parks must be regarded. The conservation of wild life is a feature not to be despised. Free as most of the parks are from public lumbering and private grazing enterprises, and protected from hunting of any kind, they have the conditions essential for the protection and propagation of wild animal life. Eventually they will become great public nature schools to which teachers and students of animal life will repair yearly for investigation and study.

The enormous increase of wild animals in the Yellowstone since it became a national park in 1872 points the way. Deer, elk, moose, bison and antelope here abound in greater numbers, no doubt, than before the days of the white man; and many of them have become almost as fearless of man as animals in captivity. From here many State, county and city parks have been supplied, under proper restrictions, with surplus animals for propagation purposes. When interfering private holdings are extinguished in other national parks, and United States laws made to supersede State laws (a condition the newly authorized Park Service will strive to bring about), these, too, will become centers of animal preservation as effective as the Yellowstone.

By an act approved June 8, 1906, entitled "An act for the preservation of American antiquities," the President of the United States is

VALLEY OF ENCHANTMENT, NEAR THE CREST OF THE SIERRA NEVADAS, YOSEMITE NATIONAL PARK

authorized, "in his discretion, to declare by public proclamation historic landmarks, historic and prehistoric structures, and other objects of historic or scientific interest, that are situated upon the lands owned or controlled by the Government of the United States, to be national monuments."

There are now thirty such national monuments, two which did exist having been eliminated with the creation of Lassen National Park.

NATIONAL MONUMENTS ADMINISTERED BY INTERIOR DEPARTMENT

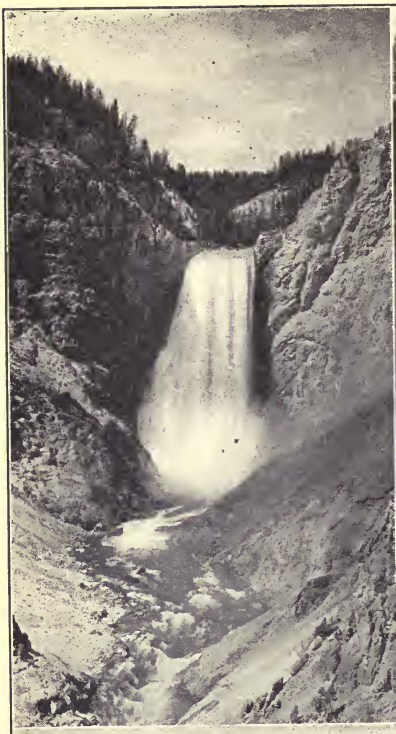
Name	State	Date	Area
			Acres
Devil's Tower	Wyoming	Sept. 24, 1906	1,152
Montezuma Castle	Arizona	Dec. 8, 1906	160
El Morro	New Mexico	Dec. 8, 1906	160
Chaco Canyon	New Mexico	Mar. 11, 1907	20,629
Muir Woods	California	Jan. 9, 1908	295
Pinnacles	California	Jan. 16, 1908	2,080
Tumacacori	Arizona	Sept. 15, 1908	10
Mukuntuweap	Utah	July 31, 1909	15,840
Shoshone Cavern	Wyoming	Sept. 21, 1909	210
Natural Bridges	Utah	Sept. 25, 1909	2,740
Gran Quivira	New Mexico	Nov. 1, 1909	160
Sitka	Alaska	Mar. 23, 1910	57
Rainbow Bridge	Utah	May 30, 1910	160
Lewis and Clark Cavern	Montana	May 16, 1911	160
Colorado	Colorado	May 24, 1911	13,883
Petrified Forest	Arizona	July 31, 1911	25,625
Navajo	Arizona	Mar. 14, 1912	360
Papago Saguaro	Arizona	Jan. 31, 1914	2,050
Dinosaur	Utah	Oct. 4, 1915	80
Sieur de Monts	Maine	July 8, 1916	5,000

ADMINISTERED BY AGRICULTURAL DEPARTMENT

Name	State	Date	Area
			Acres
Cila Cliff Dwellings	New Mexico	Nov. 16, 1907	160
Tonto	Arizona	Dec. 19, 1907	640
Grand Canyon	Arizona	Jan. 11, 1908	806,400
Jewel Caves	South Dakota	Feb. 7, 1908	1,280
Wheeler	Colorado	Dec. 7, 1908	300
Oregon Caves	Oregon	July 12, 1909	480
Devil Postpile	California	July 6, 1911	800
Mount Olympus	Washington	April 17, 1912	299,370

ADMINISTERED BY WAR DEPARTMENT

Name	State	Date	Area
			Acres
Big Hole Battle Field	Montana	June 23, 1910	5
Cabrillo	California	Oct. 14, 1913	1



Great Falls of the Yellowstone
Cleopatra Terrace

Golden Gate
Eagle Rest Rock

SOME OF THE SPLENDORS OF OUR NATIONAL PARKS

CHAPTER VIII.

GOOD ROADS AND BAD

THERE are 2,273,131 miles of public roads in the United States. Of these, 10.9 per cent (a total of 247,490 miles) are surfaced roads—roads other and presumably better than mere cuttings in the dirt.

Rhode Island leads all the Union in good roads, with a percentage of 58.8 per cent. Massachusetts comes next with 51.7, followed by Indiana 42.3, Ohio 33.8, New Jersey 30.3 and New York 27.9 per cent.

Nebraska is at the foot of the list with a percentage of 0.3, representing 250 miles of surfaced roads out of a total of 80,338. Other backward States are Nevada, 0.5 per cent, Montana 0.4 per cent, and Kansas 1 per cent.

THE SLOUGH OF DESPOND

LIFE AND PLEASURE IN GOOD ROADS

THE BURDEN OF BAD ROADS

EASY HAULAGE

POOR ROADS—FARM TO RAILROAD—COSTLY WAY

GOOD ROADS—FARM TO RAILROAD—CHEAP WAY

Ohio has the greatest good road mileage, with 28,312, Nevada the least, with 65 miles. Texas has the greatest total mileage with 128,971, Rhode Island the least with 2,121.

During the past twenty years State governments have been active in a constantly increasing measure in behalf of road improvement. To January 1, 1915, expenditures aggregating $211,879,163 had been made from the appropriations by the legislatures of 39 States. With these funds improved roads to the extent of 35,477 miles have been constructed during this period of twenty years at an average expenditure of $5,970 per mile. Yet we have not good roads—and we are paying the price. We pay in money, in lives, in ignorance, in labor, in taxes, and in high cost of living.

Considering only a few phases of the subject, the investigator is struck with the universal effect of good roads.

Data obtained from the Twelfth Census, compared with the road statistics, show clearly the relationship between illiteracy and bad roads. Many factors contribute to produce illiteracy, but it is significant that where one is found, there is usually the other. In Arkansas, Missouri, Mississippi and North Carolina, where less than 2 per cent of the roads are improved, there were 374,788 native born white illiterates in 1900, out of a total population of 7,800,000, whereas in Massachusetts, Connecticut, New Jersey and Rhode Island, where 30 per cent of the roads are improved, there were only 20,500 native born

A ROAD BEFORE IMPROVEMENT

THE SAME ROAD AFTER IMPROVEMENT—CLAY AND GRAVEL CONSTRUCTION

LIMIT OF TWO-HORSE TEAM OVER BAD ROAD—TWO BALES OF COTTON

TWELVE BALES OF COTTON ON A MACADAM ROAD

ESTIMATED 1915 COST OF MARKETING SIX OF THE MORE IMPORTANT CROPS

Crop	U. S. Production 1915	Wt. per unit	Production	Proportion over roads	Tonnage over Roads	Average haul	Ton Mileage	Cost per T. M.	Total Hauling Cost
	Bus.	Lbs.	Tons		Tons	Miles	Ton Miles		
Corn.....	3,054,535,000	70	106,908,690	.144	15,394,851	7.4	113,921,897	.19	$21,645,159
Wheat....	1,011,505,000	60	30,345,150	1.00	30,345,150	9.4	285,244,410	.19	54,196,438
Oats.....	1,540,362,000	35	26,956,335	.28	7,547,774	7.3	55,098,749	.19	10,468,762
Potatoes...	433,398,000	60	13,001,940	.75	9,751,455	8.2	79,961,931	.22	17,591,625
Cotton....	11,161,000	1,500	8,370,750	1.00	8,370,750	11.1	92,915,325	.28	26,016,291
Hay.....	85,225,000	2,000	85,225,000	.17	14,488,250	8.3	120,252,475	.19	22,847,969
Totals...			270,807,865		85,898,230		747,394,787		$152,766,244

white illiterates in 1900, out of a total population of 6,025,000.

The cost of poor roads is a terrific item in high cost of living. It costs more to ship a ton of cotton from farm to railroad than from New York to London, as is plainly shown for six great shippings in the table above.

Of the 3,114,300 autos in the world this country possesses 2,400,000—more than one for every mile of road. In 1916, 1,200,000 more will be manufactured. Imagine the cost

SMALL ROAD TAX—NO SAVING

FAIR ROAD TAX—NO LOSSES


D O M I N I O N O F C A N A D A
P A C I F I C O C E A N
A T L A N T I C O C E A N
G U L F O F M E X I C O
GULF OF CALIFORNIA
THE
LINCOLN HIGHWAY
A Connected Improved Transcontinental Highway,
Open to Lawful Traffic of all Descriptions,
Without Toll Charges.
The Route of THE LINCOLN HIGHWAY is indicated in RED
Routes and Highways, Natural Tributaries, are indicated in BLUE
Approved and Adopted, September 10th 1913, by
THE LINCOLN HIGHWAY ASSOCIATION, Inc.,
DETROIT, MICHIGAN
LARGE SCALE MAP (62 x 40 INCHES)
May be had by remitting One Dollar to the Lincoln Highway Association,
Detroit, Michigan.
SCALE OF MILES
THE WARNER AUTO-METER
You Are One of One Million!!
WHO ARE DRIVING CARS AND ARE USING THE
LINCOLN HIGHWAY
THE LINCOLN HIGHWAY, Detroit, Michigan
LINCOLN
L
HIGHWAY
ROAD MARKER
Rand McNally & Co. Engravers, Chicago

POOR ROAD—TIME IS MONEY—A DELAY

GOOD ROAD—TIME IS MONEY—THEY GOT THERE

in depreciation of these cars due to poor roads. If the cars average $500 each in value, and bad roads cost 10 per cent depreciation, these scrapped cars, due to poor roads, cost the United States $120,000,000 per year, more than half what has been spent on good roads in twenty years!

Now the Federal Government has taken hold of the problem and the sum of $85,000,000 of Federal funds was made available for constructing rural roads by the Federal Aid Road Bill, which became a law July 11, 1916. For the construction of rural post roads under co-operative arrangements with the highway departments of the various States, $75,000,000 is to be spent, the remaining $10,000,000 being for roads and trails within National forests. The Federal Government's share in co-operation with the States is to be 50 per cent of the cost.

Five million dollars is available for expenditure before June 30, 1917 Appropriations increase at the rate of five millions a year until 1921, when twenty-five millions is provided, making a total of seventy-five millions. One million dollars a year for ten years is for the development of roads and trails within National forests. The class of roads to be built and the method of construction are to be mutually agreed upon by the Secretary of Agriculture and the State highway departments.

The Act provides that the Secretary of Agriculture shall apportion the appropriation in the following manner:

One-third in the ratio the area of each State bears to the total area of all the States;

SCHOOL CHILDREN ON BAD ROAD

THE KIND OF SCHOOL AND ROAD EVERY BOY AND GIRL IS ENTITLED TO

One-third in the ratio the population of each State bears to the total population of all the States;

One-third in the ratio the mileage of rural delivery routes and star routes in each State bears to the total mileage of rural delivery routes and star routes in all the States.

States securing Federal aid must make needed repairs and maintain a reasonably smooth surface, but are not obliged to make extraordinary repairs or undertake reconstruction.

A TRACTOR ROAD GRADER

The Secretary of Agriculture, July 21, 1916, certified to the Secretary of the Treasury and the governors and State highway departments of the several States the apportionment of the first $5,000,000. In accordance with the Act, 3 per cent, or $150,000, needed for administration was deducted. The several States are eligible for the following amounts:

Alabama	$104,148.90
Arizona	68,513.52
Arkansas	82,689.10
California	151,063.92
Colorado	83,690.14
Connecticut	31,090.44
Delaware	8,184.37
Florida	55,976.27
Georgia	134,329.48
Idaho	60,463.50
Illinois	220,926.23
Indiana	135,747.62
Iowa	146,175.60
Kansas	143,207.40
Kentucky	97,471.91
Louisiana	67,474.66
Maine	48,451.50
Maryland	44,047.22
Massachusetts	73,850.95
Michigan	145,783.72
Minnesota	142,394.06
Mississippi	88,905.84
Missouri	169,720.41
Montana	98,287.19
Nebraska	106,770.81
Nevada	64,398.30
New Hampshire	20,996.62
New Jersey	59,212.68
New Mexico	78,737.81
New York	250,720.27
North Carolina	114,381.92
North Dakota	76,143.06
Ohio	186,905.42
Oklahoma	115,139.00
Oregon	78,687.37
Pennsylvania	230,644.17
Rhode Island	11,665.71
South Carolina	71,807.64
South Dakota	80,946.02
Tennessee	114,153.48
Texas	291,927.81
Utah	56,950.15
Vermont	22,844.47
Virginia	99,660.78
Washington	71,884.25
West Virginia	53,270.41
Wisconsin	128,361.82
Wyoming	61,196.07
Total	$4,850,000.00

HAULING 22½ YARDS OF CRUSHED ROCK

CHAPTER IX.

THE PANAMA CANAL

ON May 4, 1904, the United States took possession of a narrow strip of land ten miles wide, crossing the Isthmus of Panama, called the Canal Zone. On August 15, 1914, the Panama Canal was opened to commerce. Between these two dates lie all the wonder of the construction of the greatest engineering feat of all time.

But that story has been told and retold. What concerns us now is what the canal accomplishes, how it does its work, what it costs—what it is worth.

DISTANCES

The distance by water around South America is 10,500 nautical miles from Colon (Atlantic) to Balboa (Pacific). By canal the distance between the same two points is 44 miles.

The difference in length of these routes, 10,456 miles, represents the maximum distance that can be saved to a vessel by use of the canal.

So far in the use of the canal, over 40 per cent of the vessels which have passed through it have been engaged in the coastwise trade of the United States—each of them saving about 7,800 miles on each trip. If their average speed be taken at ten knots, they have averaged a saving of over a month at sea on each voyage from coast to coast. Where formerly the round trip of a ten-knot vessel required about fifty-five days' actual steaming, the time at sea for the same trip for the same vessel is now reduced to about twenty-two days.

SPEED

The transit of the canal requires about 10 hours, of which approximately 3 hours are spent in the locks. In the sea-level channels and Gaillard (formerly "Culebra") Cut, speed is limited to 6 knots; through Gatun Lake they may make 10, 12,

Photo Underwood & Underwood

STEAMSHIP "ALLIANCE," FIRST OCEAN-GOING VESSEL TO PASS THROUGH THE PANAMA CANAL, JUNE 8, 1914

and 15 knots, according to the width of the channel.

Handling a vessel through the canal is essentially the same as in any charted channel. The canal channel is accurately charted, fully equipped with aids to navigation, and governed by rules which the pilot, one of whom must be on any vessel going through, enforces.

LOCKING THROUGH

As a vessel approaches the locks, the operator at the control house indicates by an electrically operated signal if the vessel shall enter the locks, on which side, or if it shall keep back, or moor alongside the approach wall. If everything is ready for the transit of the locks, the vessel approaches the center approach wall, a pier extending a thousand feet, and connections are made with the electric towing locomotive.

The vessel then moves forward slowly until it is in the entrance chamber, when lines are thrown out on the other side and connections are made with towing locomotives on the side wall, six for the larger vessels, three on each wall of the lock chamber. Two keep forward of the vessel, holding her head to the center of the chamber; two aft, holding the vessel in check; and two slightly forward of amidships, which do most of the towing. The locomotives are secured against slipping by cogs in a rack. They are equipped with a towing windlass, which allows the prompt paying out and taking in of hawser.

Photo Underwood & Underwood

BLOWING UP A DIKE ON THE PANAMA CANAL

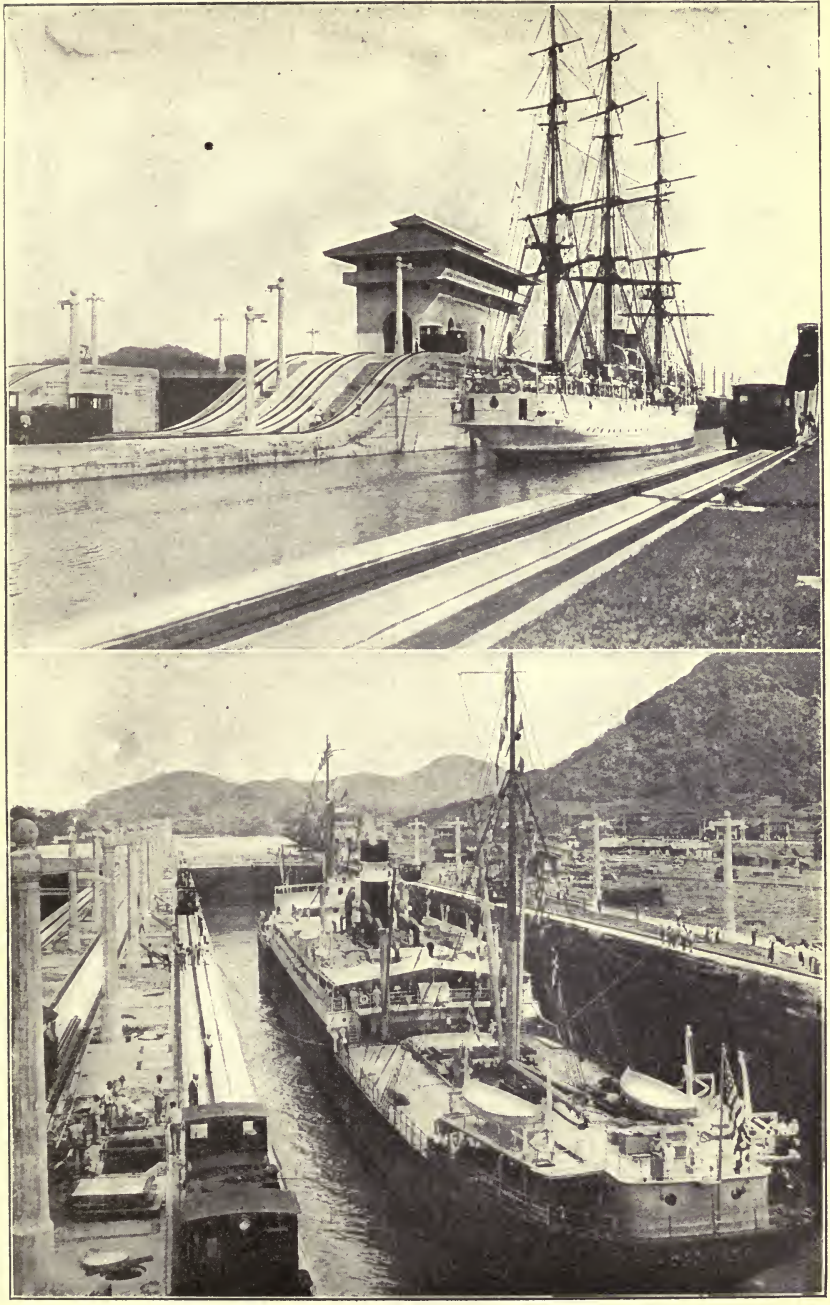
The water within the lock chamber proper, beyond the entrance chamber, is brought to the level of that in the approach, the gates toward the vessel are opened, a fender chain is lowered, and the locomotives maneuver the vessel into the chamber. The gates are closed, the water raised or lowered to the level of the next chamber, the gates at the other end are opened, and the vessel moved forward. Three such steps are made at Gatun, two at Miraflores, and one at Pedro Miguel.

STEAM SHOVELS AT WORK ON THE PANAMA CANAL CULEBRA CUT MAY 20, 1913

TRAFFIC

Ocean-going vessels to the number of 787 passed through the canal from July 1, 1915, to June 30, 1916. Their aggregate net tonnage was 2,479,761. Cargo carried through the canal on these ships amounted to 3,140,046 tons, and the ships paid in tolls $2,399,830.42.

The canal was closed in September, 1915, and remained closed, except for the transit of small vessels which had waited at the entrances for passage, until the mid-



OPERATION OF MIRAFLORES LOCKS—"PRESIDENTE SARMIENTO" ENTERING UPPER-EAST CHAMBER, JULY 14, 1915
S.S. "CRISTOBAL" IN PEDRO MIGUEL LOCKS ON RETURN TRIP THROUGH CANAL, AUGUST 4, 1914

dle of April. The operations were thus normal for slightly less than half the year.

The number of ships which passed through the canal during the preceding fiscal year was 1,088, aggregate net tonnage 3,843,035, cargo carried through 4,969,792 tons. Their tolls amounted to $4,343,383.69, after all refunds had been made.

Traffic in two years is shown below:

Item	Fiscal year 1915	Fiscal year 1916	Per cent 1916 of 1915
No. of vessels	1,088	787	72.3
Net tonnage	3,843,035	2,479,761	64.5
Tons of cargo	4,969,792	3,140,046	63.4
Tolls	$4,343,383.69	$2,399,830.42	55.3

On June 30, 1916, the total receipts of tolls from vessels passing through the canal were $2,399,830.42. The total amount expended on account of the operation and maintenance of the canal was $6,999,750.15, leaving a deficit to the amount of $4,599,919.73.

For every dollar the Government spent for operation and maintenance it received back in tolls 34.28 cents. It spent practically three times as much to maintain and operate the canal as it received in tolls.

During the preceding fiscal year the tolls had exceeded the expenses by $276,656.38, which represented a profit of 0.67 per cent on the expenditure for operation and maintenance alone, not counting anything for interest on the money invested or for depreciation of plant.

COASTWISE TRADE

Tolls on vessels in the United States coastwise trade amounted to 18.36 per cent of all tolls collected in 1916. During the preceding fiscal year, coastwise traffic yielded over 36 per cent of the total, or practically double the proportion which existed during the fiscal year 1916.

TOLLS

Canal tolls are as follows:

Merchant vessels, passengers or cargo, per net ton (each 100 cubic feet) of actual earning capacity, $1.20.

Vessels in ballast, no passengers or cargo, per ton 75 cents.

Naval vessels, other than transports, colliers, hospital ships, and supply ships, per displacement ton, 50 cents.

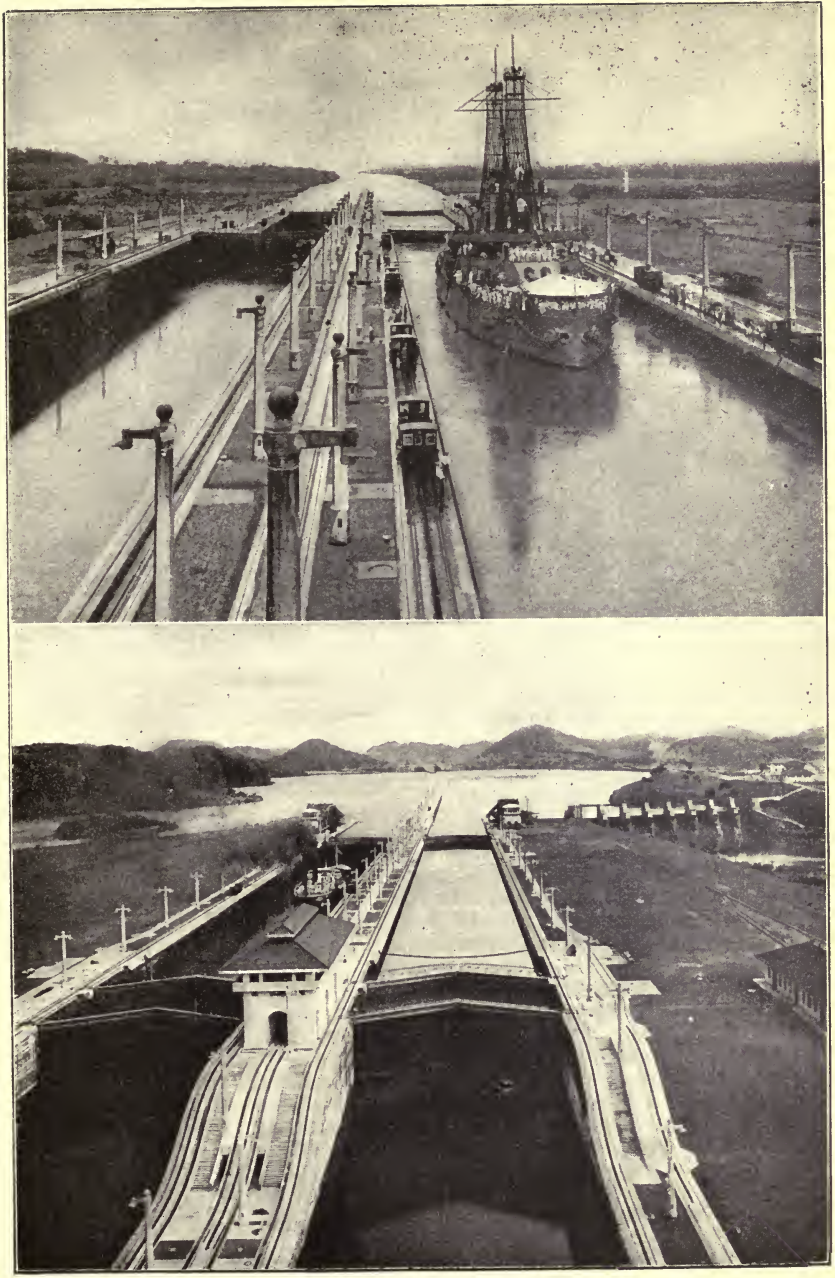
Army and Navy transports, colliers, hospital ships, and supply ships, measured as merchant vessels, per net ton, $1.20.

To the uninitiated, to whom these charges may seem heavy, the following example is given to show their justice and the saving effected by the canal.

The American Hawaiian Company

A CANAL LOCK AT NIGHT

has a liner called the "Arizonan." On a basis of a speed of 12 knots, the canal saves the "Arizonan" about 26.8 days at sea on each voyage from coast to coast. The "Arizonan" is a relatively large vessel, 470 feet long by 57.2 feet in the



OPERATION OF GATUN LOCKS, U. S. S. "WISCONSIN" IN MIDDLE-EAST CHAMBER—ATLANTIC ENTRANCE IN DISTANCE, JULY 15, 1915

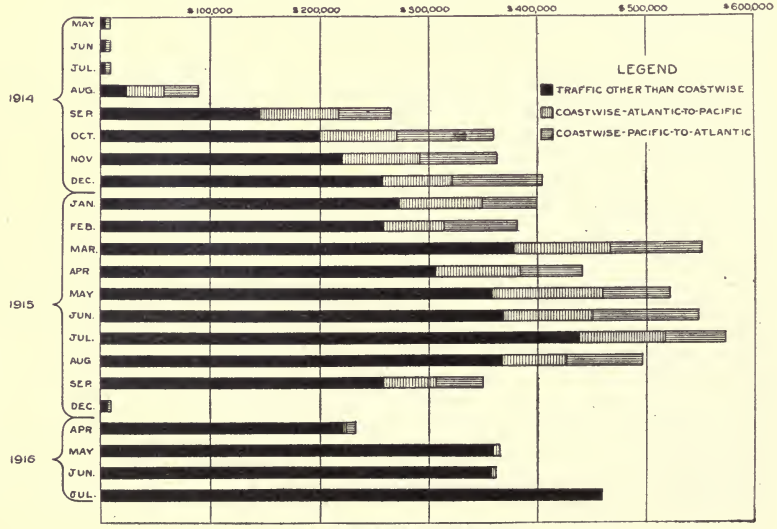
MIRAFLORES LOCKS—GENERAL VIEW, LOOKING NORTH FROM TOP OF FLOATING CRANE "HERCULES," SHOWING SPILLWAY AND LAKE—PEDRO MIGUEL LOCKS IN DISTANCE, AUGUST 28, 1915

COLLECTION BY MONTHS AND DIRECTIONS

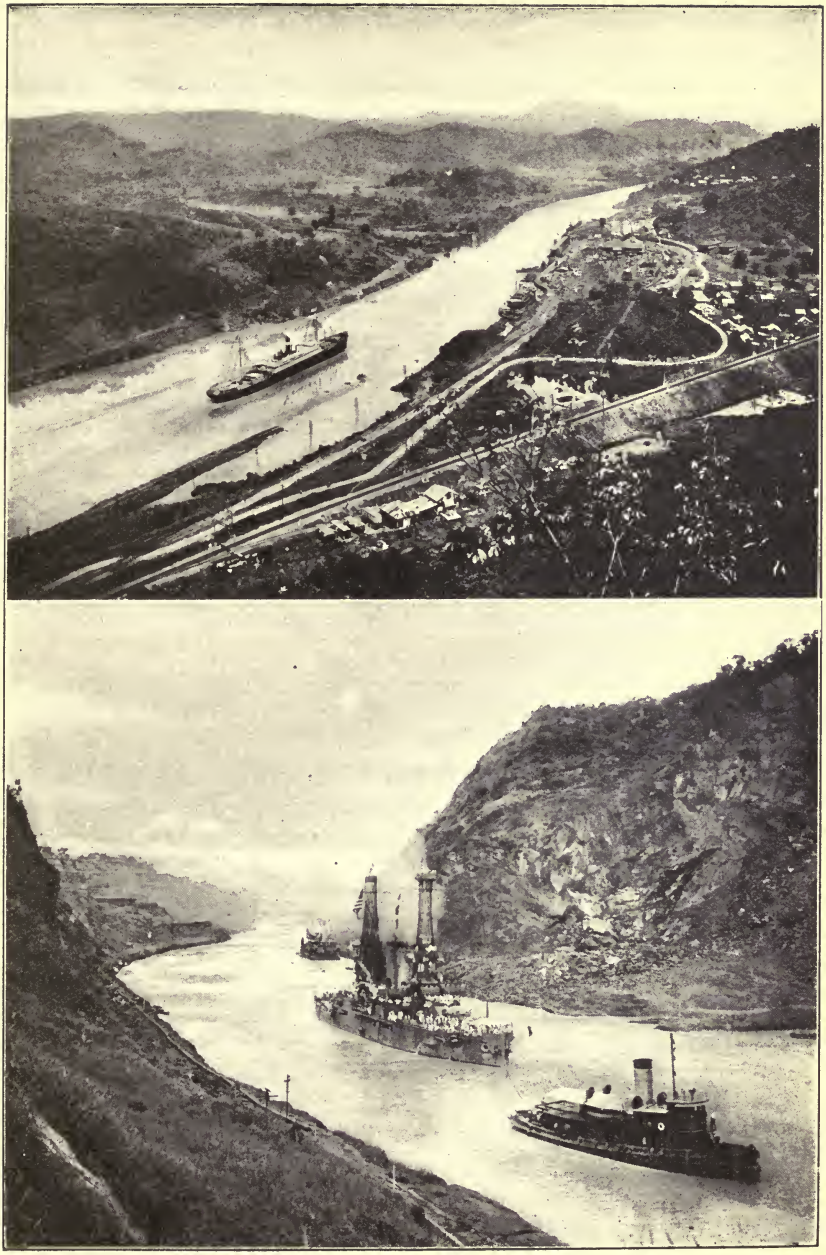
Month	Vessels entering from Pacific	Vessels entering from Atlantic	Total
1915			
July	$308,264.32	$265,101.35	$573,365.67
August	268,397.23	228,394.80	496,792.03
September	168,450.30	181,048.00	349,498.30
October	.....	.....	.....
November	.....	.....	.....
December	93.60	10,732.40	10,826.00
1916			
January	18.00	636.39	654.39
February	832.80	1.20	834.00
March	268.80	150.00	418.80
April	97,779.29	137,839.15	235,618.44
May	197,000.83	171,022.96	368,023.79
June	213,103.11	150,695.89	363,799.00
Total	$1,254,208.28	$1,145,622.14	$2,399,830.42

beam, and has carried as much as 11,780 tons of cargo through the canal on one of her voyages. The canal tolls levied on each passage are $7,891.20. The cost of operating the "Arizonan" at sea may be taken at $450 a day. For 26 days this means $11,700, from which the subtraction of the tolls leaves a net saving of approximately $3,808 per voyage.

Partly because of the many slides and the cost of their removal, partly because of the fact that they closed the canal for six months in a year and partly because of the war, the tolls do not by any means pay expenses.



PANAMA CANAL TRAFFIC



S.S. "CRISTOBAL" IN CULEBRA CUT AT PARAISO ON RETURN TRIP THROUGH CANAL—LOOKING NORTH FROM TOP OF CERRO LUISA, AUGUST 4, 1914

U.S.S. "OHIO" PASSING CUCARACHA SLIDE—LOOKING NORTH, JULY 16, 1915

CHANGE IN TOLLS CHARGES

During the first months tolls were levied on the basis of the net tonnage of ships determined by specially formulated rules for measurement for the Panama Canal, in which the net tonnage was the space available for carrying cargo, reckoned in tons of 100 cubic feet. Following an interpretation of the Panama Canal Act by the Attorney General, the amount of tolls collectable has been governed also by the net tonnage as determined by the rules for registry in the United States, it having been decided that the tolls should not exceed $1.25 per net ton on this basis.

The result of this system has been a loss in revenue. During the fiscal year ending June 30, 1916, the tolls collected amounted to $2,395,928.77. If the original Panama Canal rules had been adhered to, collections would have amounted to $2,786,642.82, a difference of $390,714.05, 14.05 per cent of the hypothetical earnings under the original system, and 16.3 per cent of the amount actually collected.

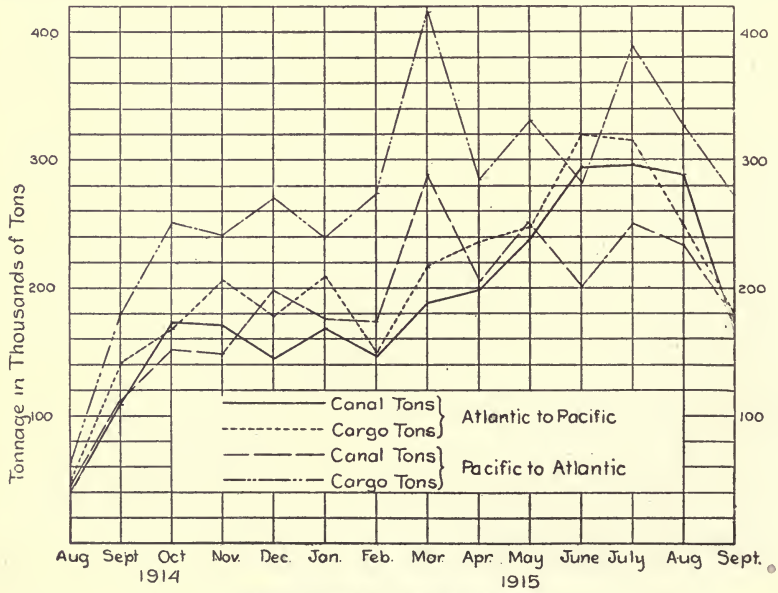
CHARACTER OF FREIGHT.

Twenty principal commodities together made up 67 per cent of all cargo carried through the canal, being 2,009,897 tons out of a grand total of 3,140,046 tons. The miscellaneous articles other than the twelve principal commodities aggregated 1,130,149 tons.

Nitrates amounted to 894,139 tons; refined petroleum to 271,041; coal, 243,216; sugar, 128,544; lumber, 96,685; manufactured goods of iron and steel, 87,375; crude oil, 69,812; railroad material, 57,829; iron ore, 52,250; canned goods, 41,300; barley, 38,006; and copper, 36,700 tons.

CANAL FORCE

Many people have an idea that because the canal is finished and open for business therefore the Isthmus is depopulated. How far wrong this



CROSS TRAFFIC IN THE CANAL

is may be seen by the following statement of the working force actually engaged during the last week of July, 1916:

The occupants of Government quarters numbered 6,772 Americans, of whom 3,747 were men, 1,454 women, and 1,571 children; and 10,925 West Indians, of whom 5,880 were men, 2,188 women, and 2,857 children.

Department or Division	
Operation and Maintenance:	
Locks and office	713
Terminal construction	752
Building	2,243
Electrical	572
Municipal Engineering	2,826
Dredging	2,692
Mechanical	2,550
Marine	277
Fortification	388
General Construction	59
Total	13,072
Supply:	
Commissary	1,976
Subsistence	381
Quartermaster	2,103
Accounting	213
Health	1,019
Executive	466
Panama Railroad	4,690
Contractors	198
Grand Total	24,121

RECENT IMPROVEMENTS

The new 1,000-foot dry dock at Balboa was put in active commercial service the last of August, 1916. The first use of the dock was on June 27, with the docking of the dredge "Corozal," and since that time other canal vessels have been docked. The first privately owned vessel to make use of it was the 81-ton auxiliary schooner "Chiriqui," registered in Panama, which entered the dock on Tuesday, August 22.

The first commercial use of the new coaling plant at the Atlantic terminus of the canal was made in the morning of Wednesday, August 30, when the steamship "Otaki" was taken alongside the reloader wharf to receive 550 tons of coal.

GAILLARD CUT CULEBRA—LOOKING NORTH FROM CONTRACTOR'S HILL, SHOWING BARRIER ACROSS CANAL FORMED BY SLIDES FROM EAST AND WEST BANKS, NOVEMBER 18, 1915

SLIDES

So much has been said of the closing of, or interference of the operation of, the canal by slides, that most people have a confused idea that the mountains on each side of the canal are gradually sliding into it, and some have even come to believe that the canal will one day be known as a gigantic engineering failure.

Space forbids going into the subject. But for the comfort of those who are anxious lest we have spent our money and time for nothing, the following quotation from Major General George W. Goethals' paper on "Slides at Panama," published Jan. 5, 1916, may well be printed here:

"It is certain the slides are due to the failure of underlying strata, because these were unable to bear the weight that the banks brought upon them. Under the circumstances it is difficult to understand the impression that has gained credence in some quarters that a sea-level canal would have avoided the difficulties encountered, since the cutting would have been through the same material, but at least 80 feet deeper.

"It is also certain that nothing can stop the movements until the angle of repose is reached for the materials under the conditions that exist, and that this can be reached only by removing the excess amount of material. If experience counts for aught, then that gained in the handling of the slides and the breaks that have occurred along the line of the canal *leaves no doubt* that the means adopted and now in use will effect a cure; furthermore, that when cured no further troubles need be anticipated from slides in this locality."

COL. GOETHALS, U.S.A., THE PANAMA CANAL BUILDER

CHAPTER X.

THE THREE GREAT GOVERNMENT SURVEYS

GEOLOGICAL, COAST AND GEODETIC AND HYDROGRAPHIC

THE GEOLOGICAL SURVEY

VITAL to the proper development of our great natural resources is an accurate knowledge of those resources. It is with these that the Geological Survey is concerned, with their investigation, their development and their proper exploitation.

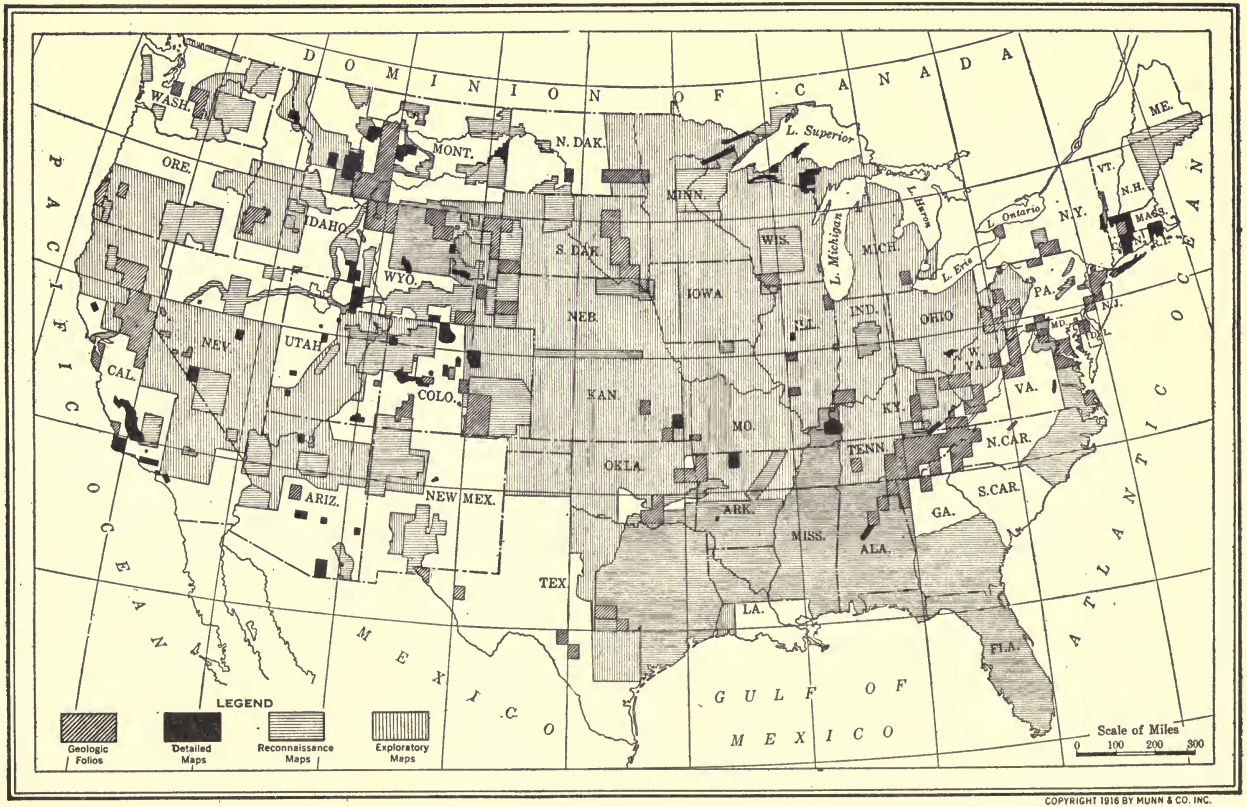
ACCURATE MEASUREMENT WORK IN THE FIELD.—GEODETIC SURVEY

Spending $1,620,520 in the last fiscal year for which a report is available (to June 30, 1915) the Geological Survey's work can hardly be summed up in a sentence. During the year geological investigations were made in 47 States and Alaska; topographic surveys were made in 30 States, Alaska and Hawaii, and stream measurements were made in 41 States and Hawaii. The total area covered by geologists in reconnaissance and detailed surveys was more than 76,000 square miles and the area topographically mapped by the topographers was more than 35,000 square miles. The land classification work of the Geological Survey last year resulted in the classification of about 36,000 square miles in the public land States. In the collection of statistics of mineral production the Geological Survey cooperated with the State geologists of 16 States and carried on correspondence with 90,000 producers, as well as answering over 50,000 letters of inquiry.

The bureau divides its activities into the Geologic, Topographic, Water Resources, Land Classification, Publication and Administrative branches.

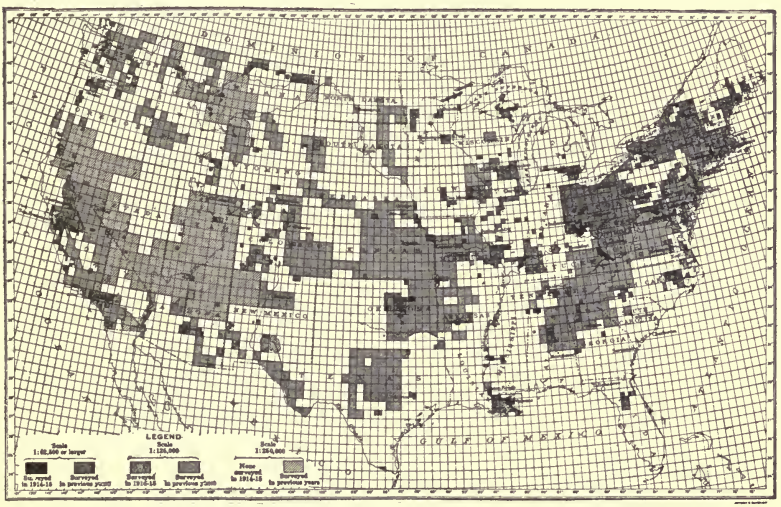
Geological Branch

The original duties of the geologic



MAP OF THE UNITED STATES, SHOWING AREAS COVERED BY GEOLOGIC MAPS PUBLISHED PRIOR TO JULY 1, 1915

branch were the classification of the public lands and the examination of the geological structure, mineral resources and products of the national domain. These duties were at first construed to apply only to the public land States. Later, however, in order that all parts of the country might share alike in the benefits of its work, the survey was specifically authorized "to continue the preparation of a geological map of the United States," the scope of its



MAP OF THE UNITED STATES SHOWING AREAS COVERED BY TOPOGRAPHIC SURVEYS PRIOR TO JULY 1, 1915

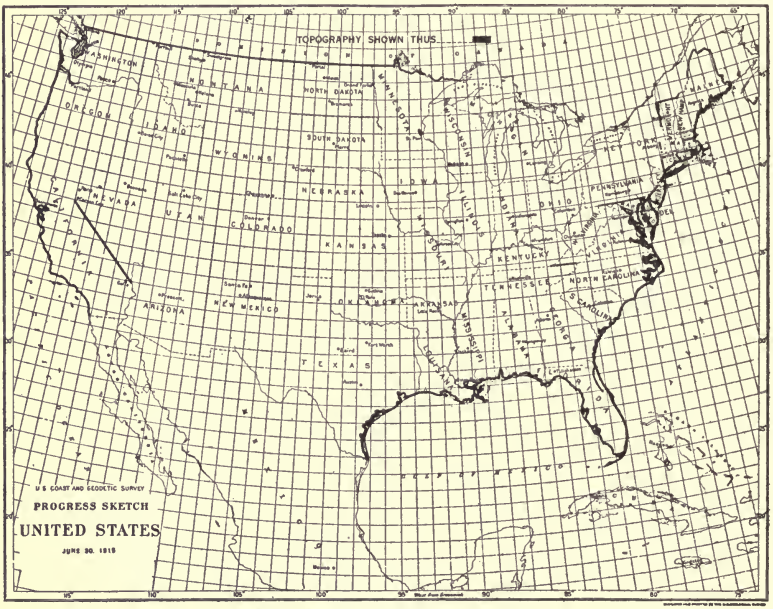
operations being thus made nationwide. Since that time (1882) the investigations necessary to the fulfillment of the survey's obligations to the public have become as varied as the aspects of geology itself.

The geologic branch is the effective agency of the survey in investigations in all parts of the United States and Alaska and also the great geologic information bureau to which the American public, from Key West to Point Barrow and from San Diego to Eastport, applies for knowledge of every sort concerning the earth's crust and its mineral constituents. The survey is a source of geologic information regarding not only the geology of the United States and its possessions, but also that of Mexico, Central America and even South America. By correspondence it is asked for data regarding the geology and mineral deposits of all parts of the world. The geologic branch has the double task of geologic surveying, including the investigation, description and mapping of the geology and mineral deposits of all parts of the country; the classification of the public lands and the publication of the results of its work, and furnishing to the public miscellaneous geologic information derived from all sources.

But it is not to the general public only that its services are rendered direct. Probably no one bureau of the Government co-operates with so many others in their work as does this survey.

The survey co-operates with the

Bureau of Mines in the metallographic study of ores, in the investigation of the invasion of California oil wells by salt water, in studies of the application of geology to engineering problems of mining and construction and in the examination of placers and placer mining in the United States. The survey is engaged with the Bureau of Standards, the Bureau of Mines and the Office of Public Roads in a systematic study of building stones. It cooperated informally with the Smithsonian Institution, Bureau of Fisheries, Forest Service, Navy Department, War Department and Lighthouse Service, as well as with institutions of learning, including the Geophysical Laboratory and Marine Biological Station of the Carnegie Institution. Services are rendered to the Department of Agriculture in the examination of lands in the national forests; to the Department of Justice in connection with suits regarding public lands; to the Navy Department in regard to oil and water supplies; to the Office of Indian Affairs in the classification of Indian lands; to the War Department with reference to water supplies in its reservations, and to the General Land Office in the classification of withdrawn coal, oil and phosphate lands.



COAST AND GEODETIC SURVEYS

Topographic Work

The general public is perhaps more familiar with the work of the topographic branch of the survey than with any other, since most people at one time or another have use for accurate maps of the country in which they live or intend to visit. Carried on in co-operation with the States, the work of mapping the whole country has made great progress, 40.2 per cent of the entire area—and that the most important, economically considered—having

1. Plane Table Work. 2. Lad Signaling Roadman to Move. 3. Reading Microscopically in Precise Measurement Work in the Field. 4. Erecting a Signal Over a Recovered Triangulation Point

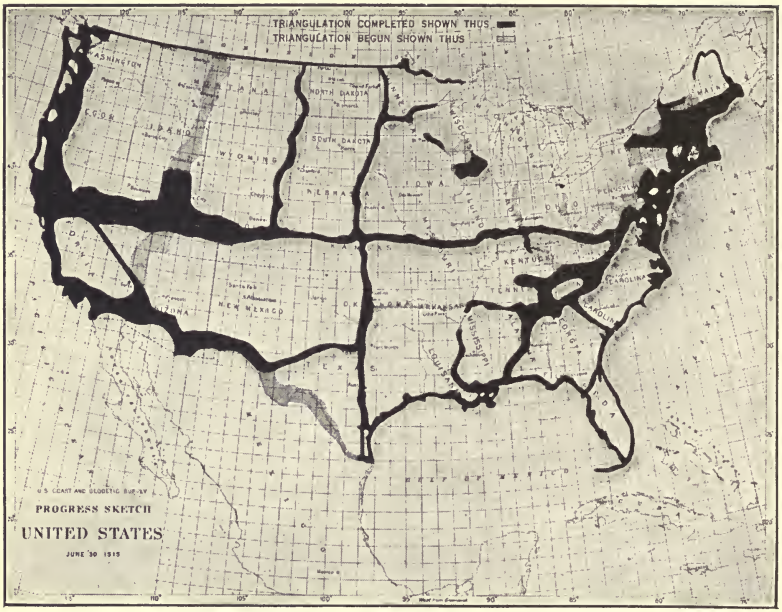
THE GEODETIC SURVEYORS AT WORK

PRESENT CONDITION OF TOPOGRAPHIC SURVEYS OF THE UNITED STATES AND NEW AREAS SURVEYED JULY 1, 1914 TO JUNE 30, 1915

	Area mapped to June 30, 1915	Percentage of total area of State mapped to June 30, 1915
	Sq. Miles	
Alabama	19,192	37
Arizona	68,996	61
Arkansas	21,380	40
California	114,708	72
Colorado	48,783	47
Connecticut	4,965	100
Delaware	1,202	51
District of Columbia	70	100
Florida	2,339	4
Georgia	17,337	29
Idaho	26,185	31
Illinois	14,551	26
Indiana	3,441	9
Iowa	11,652	21
Kansas	64,159	78
Kentucky	17,973	44
Louisiana	8,319	17
Maine	9,361	28
Maryland	12,327	100
Massachusetts	8,266	100
Michigan	6,018	10
Minnesota	6,541	8
Mississippi	2,126	4
Missouri	36,710	53
Montana	57,163	39
Nebraska	26,524	34
Nevada	51,115	46
New Hampshire	3,380	36
New Jersey	8,224	100
New Mexico	37,247	30
New York	43,553	89
North Carolina	18,390	35
North Dakota	9,716	14
Ohio	40,018	97
Oklahoma	39,851	57
Oregon	23,406	24
Pennsylvania	24,908	55
Rhode Island	1,248	100
South Carolina	5,640	18
South Dakota	18,594	24
Tennessee	21,153	50
Texas	67,782	25
Utah	68,797	81
Vermont	4,190	44
Virginia	29,980	70
Washington	26,033	38
West Virginia	24,170	100
Wisconsin	12,203	21
Wyoming	28,404	29
Total	1,218,290	40.2
Hawaii	1,393	22

Pack horses laboring up a narrow trail in Alaska
Climbing a precipitous cliff

Surveying along the coast in Alaska. During the summer there is from 16 to 22 hours of daylight
Scaling Mt. St. Elias to establish a Triangulation Station
THE ROMANCE OF SURVEYING



TRIANGULATION SURVEY

been surveyed and published. The table on page 124 gives the data for each State.

These maps, most beautifully engraved and printed, can be obtained at a nominal price. A key map, showing just what portions of each State are available, should be secured first by application to the survey, from which selections can be made as desired. The maps are in color and accurate with the accuracy of the highest degree of engineering skill.

Water Resources—Land Classification

Immensely important though they are, space forbids any extensive report of the work of the water resources branch. Full information in regard to the water work in forty-one States and Hawaii, of which twenty-six have co-operated, as have the Reclamation, Indian and Public Health Service and many army engineers, can be had on application to the survey.

Similarly the land classification, and the withdrawal and restoration of public lands with relation to their oil, coal and mineral deposits, is a subject too big for extended notice here and too special for a popular report. More than 36,000 square miles of land were classified in the year just passed.

Publications

The work of the Geological Survey is largely made available to the public by distribution of printed reports and maps. The publications of a year consisted of 1 annual report, 1 monograph, 5 professional papers, 10 separate chapters from 2 professional papers, 35 bulletins, 30 separate chapters from 5 bulletins, 33 water supply papers, 18 separate chapters from 4 water supply papers,

1 annual report on mineral resources for 1913 (published also in 62 advance chapters, 15 delivered in 1913-14 and 47 in 1914-15), 5 advance chapters from the annual report on mineral resources for 1914, 3 geologic folios, 2 lists of publications, 1 list of topographic maps and folios, pamphlets entitled "Topographic Instructions of the United States Geological Survey, 1915," and "Service Bulletin, 1914," leaflets entitled "Nature and Uses of Topographic Maps,"

PRECISE LEVELING

"The Production of Copper in 1914" and "The Production of Spelter in 1914," 3 circulars concerning geologic folios, 22 index map circulars, 55 press bulletins and 10 monthly lists of new publications.

A complete list of all Geological Survey publications, with their cost price, can be obtained from the Superintendent of Public Documents. Government Printing Office, Washington, D. C., to whom application should be made by those desiring to obtain such publications. Maps, however, are obtainable from the survey direct, as stated above.

COAST AND GEODETIC SURVEY

A bureau of the Department of Commerce, the Coast Survey performs work seldom heard of by the general public, of the most vital importance not only to the scientific world but the public itself.

Every coast chart, on which the vessels of the navy and the maritime world in general depend for safety of both life and property, is made by the Coast Survey. Its charts are models for all the world for both accuracy and beauty.

The books of tide tables, on which all mariners depend for tide conditions in harbors and along the coasts, are published by the Coast Survey. Most remarkable of books, these enormous summaries of calculations are not the work of human hands and brains but the result of the labor of the most wonderful calculating machine in the world—the tide predicting engine. A huge affair of wheels and shafts, occupying a mahogany and glass case which fills a room of the bureau, this most accurate and intricate of machines does the work of a hundred computers and more accurately than any human being could do it.

In addition to the preparation and printing and issuing of coast charts, the survey conducts triangulation work which will in time gridiron the whole United States, determines latitudes, investigates magnetic phenomena, conducts precise leveling, makes special surveys and performs a host of special duties, such as supplying experts for duty on International Boundary Commissions, International Geodetic Association, Board of Life Saving Appliances, Mississippi River Commission, cooperation with Alaskan Engineering Commission, etc.

Its hydrographic work for coast charts is of the highest importance and its development of what is known as the "wire drag" has revolutionized all such work. No matter how closely soundings may be made of a harbor, for instance, it is impossible to be certain that all sunken rocks, wrecks, shoals or other obstructions to navigation have been discovered. But with a submerged wire drag of a known depth, dragged through the water between two widely separate vessels, a positive result is obtained resulting in a security beyond price to the mariner.

In its work the Coast Survey sends out numerous parties which work along the coasts, or, if triangulation or leveling is being done,

in the interior. Many vessels are used for coast work, including the steamers "Bache," "Endeavor" (now sold), "Hydrographer," "Isis," "Explorer," "Gedney," "McArthur," "Patterson," "Taku" and "Yukon" and the schooner "Matchless."

In the Philippine Islands five vessels aid the work of the survey, reporting to the suboffice at Manila. This work is prosecuted partly with funds of the survey and partly with funds from the Philippine Government, which also furnishes four of the five vessels engaged. The ships are the "Pathfinder," "Marinduque," "Romblon," "Fathomer" and "Research."

PLANE TABLE WORK IN THE WATER IN THE PHILIPPINES

It is difficult, if not impossible, to cover in a few words the extensive and varied work of a bureau which requires a closely printed report of 156 pages to show a year's activities. But in spite of the fact that the determination of astronomic latitudes, the determination of gravity intensity, the prosecution of triangulation, the wire-drag hydrographic work which last year discovered and charted hundreds of shoals and obstructions to navigation, the coast pilot work, the tidal determination and publications, the assistance rendered vessels and mariners in distress, the precise leveling, the special surveys and special services rendered by the bureau, the determination of magnetic elements, dip, declination and horizontal intensity made in 31 States, are all highly important, it is after all the coast charting and the printing and distribution of these charts which are the most indispensable features of this highly important scientific bureau.

During the year there were printed:

Lithographic charts	62,036
Engraved charts	53,611
Miscellaneous lithographic prints	22,417
Miscellaneous engraved prints	25
Total	138,039

a total of 304,799 impressions from the press.

The charts issued during the year were 119,387, an increase of 1,895 over the previous year. Thirty-nine thousand one hundred and twenty-four of these charts were issued to the Hydrographic Office for navy use and 52,855 supplied the merchant marine through sales agents. Coast pilots were issued to the number of 6,291, and tide tables for the Atlantic Coast 2,050, Pacific Coast 10,775, General 2,206.

The appropriation for 1915 was $1,039,730. For 1916 it was $1,365,620, most of the increase being for two new and badly needed vessels. The money is expended as follows:

For field expenses	$355,400
Repairs and maintenance of vessels	40,000
Officers and men, vessels	252,200
Pay of field officers	174,600
Pay of office force	204,420
Office expenses	500,000
Two new vessels	289,000

The urgent need of the Coast and Geodetic Survey is for new quarters. Occupying several old build-

ings, none of them built for the purpose (one was once a hotel, another a private house!) much time, money and efficiency is wasted from lack of proper facilities. Already in the first rank in naval and maritime importance, this Government bureau will, when allowed to expand and work under proper conditions, take its place in popular estimation with other better known but no more important bureaus of the Government which, because of their popular appeal, fare so much better at the hands of Congress.

The Hydrographic Office also publishes sailing directions and manuals for the safe navigation of vessels based on the original surveys and reports, or upon similar publications or information received from foreign hydrographic offices.

The Hydrographic Office also issues a number of publications. The Weekly Notice for Mariners is a publication for which the demand increases greatly from year to year. During the fiscal year ending 1915, 277,420 whole weekly notices and 241,748 extracts therefrom were published. The information given in this journal is in regard to the correction of existing charts, sailing directions necessary and essential to safe navigation, such as changes in lights, buoys, beacons, wrecks and shoals.

The Daily Memorandum comprises publication of information affecting

HYDROGRAPHIC SURVEYS

HYDROGRAPHIC OFFICE

The Hydrographic Office of the United States Navy supplements the work of the Coast and Geodetic Survey in chartmaking by providing both for the United States naval vessels, and for all mariners who have use for them, charts of the coasts of all the world.

the *immediate* safe navigation of vessels, which include the presence of icebergs, field ice, derelicts, wrecks, missing buoys, etc. This information, in addition to being published in the Daily Memorandum, is telephoned or telegraphed to the various radio stations and sent broadcast to all shipping four times a day.

The Hydrographic Bulletin, which is issued weekly, totaled for the past year 247,468 copies. It contains the vessels of the navy. It furnishes free of cost to all other Government vessels such charts and publications as are requested, and the same material is sold at the cost of printing and paper to the merchant marine or the public in general.

By international agreement the United States receives from all foreign hydrographic offices two copies of all charts issued by them, and supplies to them two copies of all charts issued by it. Of all foreign

WIRE DRAG FOR SURVEYING THE SURFACE OF THE BOTTOM

many items of interest to seafaring people and is an important member of the publication family of this office.

One hundred and twenty-four book publications are issued by the Hydrographic Office, which are necessary to the maritime public. They include such volumes as American Practical Navigator, List of Lights, International Code of Signals, Line of Position Tables, Africa Pilot, British Island Pilot, Mediterranean Pilot, etc.

The Hydrographic Office supplies all charts and navigational publications, whatever their character, to hydrographic offices the British Admiralty is, of course, the largest and most efficient. The United States has had to depend very largely upon charts issued by the British Admiralty, not only for information but for the actual charts themselves, so that the number purchased in the past year was 19,222. Altogether at the end of the fiscal year the United States depended upon the British Admiralty for 1,494 individual charts of various parts of the world. These, however, are rapidly being reproduced by the Hydrographic Office by a photolithographic process on zinc plates. The result

A GREAT BRASS BRAIN—THE WONDERFUL TIDE PREDICTOR

of this reproduction will be both to save the purchase price of such charts from a foreign government and to make the United States independent of any foreign government for the supplying of world charts to its own navy.

Navigational charts to the number of 123,158 and pilot charts to the number of 205,226 were published on a large scale and covering the approaches to the Panama Canal, has been issued. Pilot charts are in great demand, showing, as they do, tracks of just past storms, prevailing wind directions, compass variation and other maritime information, making them extremely valuable even to a vessel well supplied with regulation charts.

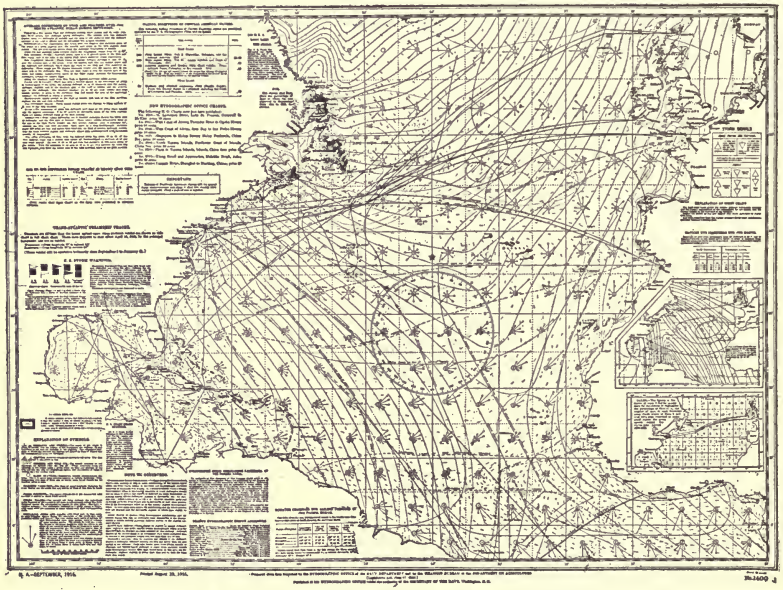


CHART OF THE NORTH ATLANTIC OCEAN

by the Hydrographic Office during the past year. At the end of the year the Hydrographic Office had on issue the following charts:

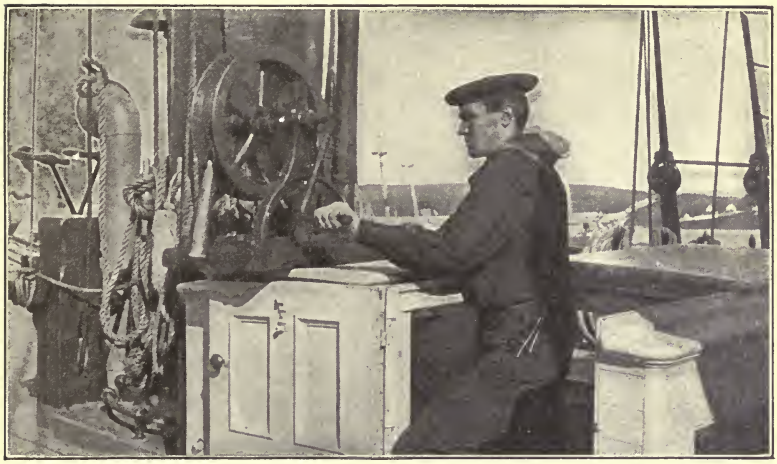
Hydrographic Office charts.....	2,281
Coast and Geodetic Survey charts	664
British Admiralty charts.....	1,494
Total	4,439

The pilot charts are published monthly for the North Atlantic, North Pacific and Indian Oceans and quarterly for the South Atlantic and South Pacific Oceans. In addition to these a new pilot chart of Central American waters, printed

Sixteen branch Hydrographic Offices are maintained, located as follows: Boston, New York, Philadelphia, Baltimore, Norfolk, Savannah, New Orleans, Galveston, San Francisco, Portland, Ore., Seattle, Duluth, Sault Sainte Marie, Chicago, Cleveland and Buffalo.

In addition to these there are 52 agents in the United States, located in 37 cities and towns, and 12 agents in foreign countries for the sale of Hydrographic Office publications.

The branch Hydrographic Offices are engaged in collecting and dis-



TAKING UP SAMPLES OF BOTTOM WITH HAND REEL

tributing hydrographic information. They endeavor to give assistance to officers and men of merchant vessels both as to data pertaining to the seas traveled and personal instructions in navigation. The popularity of the work of assistance rendered by these branch offices is shown by the large number of ship captains, agents, pilots and other seafaring men who visited the several branch offices during the year. In 1915 there was a total of 40,646 visitors and over 26,000 telephone calls, relative to correct chronometer time and other items of nautical information were answered.

A large supply of all charts issued by the office is kept on file in the main office in Washington. Sending these out on demand is a very important work of the Hydrographic Office, since to issue a chart not up to date in any and every particular might cost many lives and the loss of much property.

Thus no chart is sent out until it has been corrected to date and by hand with all alterations made necessary by changes in lights, new information in regard to depth, the presence of wrecks or other obstructions to navigation, etc. As an indication of the size of this work it may be mentioned that during the fiscal year there were transferred from old to new copies of charts some 18,000 corrections, and handled by requisition or for plotting and reference about 9,000 charts. Including new issues the total number of copies of charts printed during the year was 328,484.

CHAPTER XI.

GOVERNMENT PROTECTION OF LIFE AND PROPERTY AT SEA

BUREAU OF LIGHTHOUSES.

HAVING the greatest coast-line in the world, the United States also occupies the proud position of having the largest, finest and most competent lighthouse establishment in the world. Not yet has it reached the full flower of perfection which will obtain when the ideal of the service is realized—lighthouses so numerous and so well placed that it will be impossible for a coastwise vessel to sail out of the radiance of one without coming into view of the next. But great progress has been made toward this end, and the building, both of structures and of traditions, of apparatus and of the service itself, has been so well and carefully done that the service is a permanent asset not only to all our own shipping, but to the shipping of the world.

Moreover, to the credit of the country be it said, there are no "light dues" which any foreign or domestic vessel must pay. Uncle Sam lights his coasts and says in effect to all who go down to the sea in ships, "The light I give you for your safety is emblematic of this land—it is free."

Just how big the establishment must be is realized more easily by considering the enormous size of coast line than in any other way. Measured in steps of thirty miles it is huge; measured in steps of three miles, which go into and out of a multitude of bays, coves, shelters, inlets, etc., it is enormous. The table on page 136 shows just how big it really is.

To protect such a coast line requires an infinite variety of warning devices, and a great number of each. There are 1,662 lights other than the 2,837 so-called minor lights, 53 stations on which are maintained light vessels, commonly called lightships, 479 gas buoys, and 124 float lights, a total of 5,155 lighted aids to navigation.

The unlighted aids to navigation are scarcely less important and even greater in number. Five hundred and twenty-seven fog signals blare raucously in fog and mist, 50 submarine signals give their peculiar warnings, 86 unlighted whistling buoys and 237 unlighted bell buoys give their mournful notes, 2,001 day-beacons show the way and 6,488 other buoys mark channels and shoals, a total of 9,389 unlighted aids to navigation and a grand total of 14,544 aids to navigation of all kinds. These and other statistics here given are as of June 30, 1915.

It is evident that the lighthouse establishment of the United States must require considerable money to conduct and the able efforts of a fair army of people. The appropriation for the maintenance of the service for 1916 was $5,164,030, which included $250,000 for new lighthouse tenders. Of the balance, $2,775,000 will go for general expenses and the rest for salaries and pay.

The service is divided into nine-

TOTAL SEACOAST LINE UNDER JURISDICTION OF THE UNITED STATES

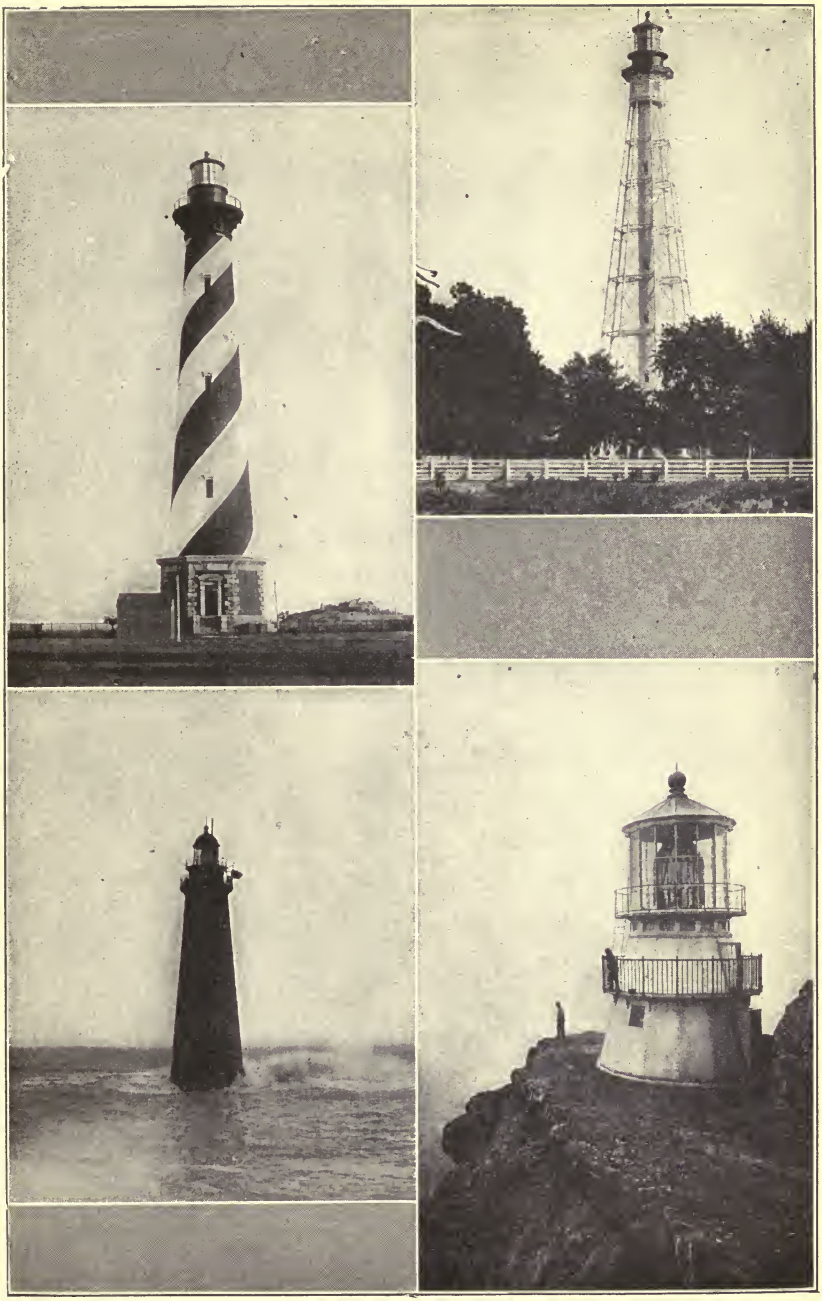
	General coast line in steps of 30 miles	Detailed coast or channel line in steps of 3 miles
	Statute miles	Statute miles
Atlantic and Gulf coasts of the United States	3,480	9,732
Pacific coast of the United States	1,404	3,294
Porto Rico, adjacent United States islands, and Guantanamo	374	449
Great Lakes and connecting waters, United States portion	2,520	4,020
Alaska	7,300	22,654
Hawaiian Islands and Midway Islands	788	1,018
Guam	86	92
American Samoan Islands	76	91
Total coast line under United States Lighthouse Service	16,028	41,350
Coastal rivers on which aids to navigation are maintained by the United States Lighthouse Service (Atlantic and Gulf coasts, 1,374 miles; Pacific coast, 242 miles)	....	1,616
Interior rivers on which aids to navigation are maintained by the United States Lighthouse Service (Mississippi River, 1,920 miles; Ohio River, 967 miles; Missouri River, 390 miles; other rivers, 949 miles)	....	4,226
Total coast line and rivers under United States Lighthouse Service	....	47,192
Philippine Islands (lighted by Philippine Government)	4,080	11,571
Panama Canal Zone (coast line only)	17	40
Total seacoast line under the jurisdiction of the United States (not including Great Lakes and rivers)	17,605	48,881

teen districts, each with its own inspector and force. In the Bureau at Washington and the nineteen districts, there are 123 inspectors, engineers, draftsmen, mechanicians, etc., 145 clerks, messengers, janitors and office laborers, 71 depot keepers and assistants, 1,471 light keepers and assistants, 226 laborers in charge of minor lights, 1,556 laborers in charge of post lights and buoys, 12 custodians of reservations, 1,605 officers and crews on tenders and light vessels, 278 employees of the field force for construction and repair (registered) and 305 of the same unregistered, a total of 5,792 employees.

Forty-four depots are maintained in the various districts for storage and distribution of supplies, repairs to apparatus, scraping and painting of buoys, and similar purposes. Forty-six lighthouse tenders carry supplies to and from the various depots, supply lighthouses which cannot otherwise be reached with food, coal, fuel oil and supplies, put down and take up buoys, attend beacon and fog signals, and in general keep the aids to navigation where they belong and performing their duties. During the year these forty-six vessels steamed a total of 469,000 nautical miles.

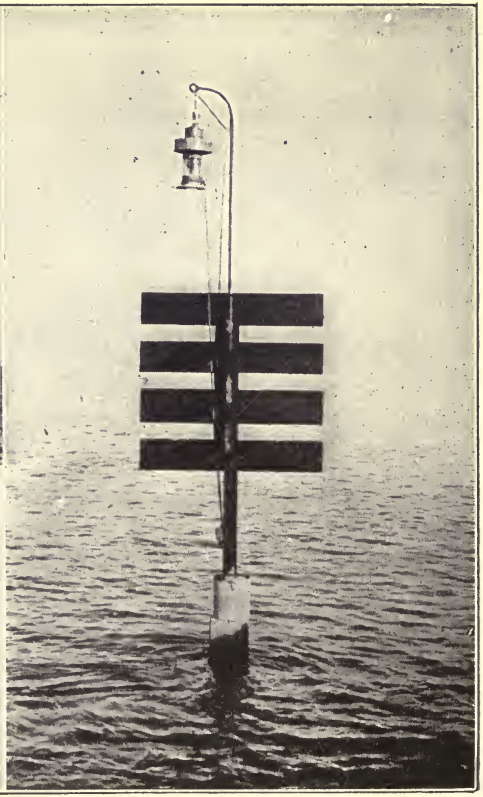
The fifty-three light vessel stations are kept supplied with ships from the total fleet of 66 light vessels. Thirty-five of these are steamers, 29 are sailing vessels.

The service is one of warning and of aid to navigation, yet its crews have always co-operated with the Life Saving Service (now incorporated in the Coast Guard) or taken the initiative where necessary in the saving of life and property. It is merely incidental but none the less worthy of note that during the year on 143 occasions, services were rendered in the saving of life or property by employees of the service.



CAPE HATTERAS LIGHT STATION
MINOT'S LEDGE LIGHT STATION, MASS.
CAPE CHARLES LIGHT STATION, VA.
POINT REYES LIGHT STATION, CALIF.

THE PROTECTORS OF THE FAIRWAYS OF COMMERCE



San Francisco Light Vessel No. 70
Cape Henry Fog Horn, Cape Henry, Va.

Sand Shoal Inlet Light, Va.

THE PROTECTORS OF THE FAIRWAYS OF COMMERCE

The service publishes a great many different booklets, which include six light lists for the various coasts and rivers, buoy lists for each of its nineteen districts, a weekly "Notice to Mariners," of which almost 200,000 copies are distributed yearly, a monthly lighthouse service bulletin, for employees, etc.

The ideals and *esprit de corps* of the service are of the highest, and the efficiency of the various crews, their pride in their work, and their determination to "keep the light burning" make of the service one which is literally the standard of the world.

THE COAST GUARD

On January 28, 1915, the Coast Guard Act was passed, merging into one great service two which had previously served the maritime world together, but under separate administration.

The Revenue Cutter Service was originally established in 1790, at the second session of the First Congress, upon the recommendation of the first Secretary of the Treasury, as the result of the need for the services of a coast patrol for the enforcement of the customs laws and an organized armed force for the protection of the sea coast, there being at that time no naval establishment.

The Life Saving Service was not the creation of a single legislative act, but the result of a series of enactments dating back to 1848, which had in view the preservation of life and property from shipwreck. In 1871 a definite life-saving system was inaugurated and administered in conjunction with the Revenue Cutter Service until June 18, 1878, when Congress established the Life Saving Service as a separate organization.

As the Life Saving Service was maintained for the purpose of saving life and property along the coast, and as one of the principal functions of the Revenue Cutter Service in time of peace was to perform similar duties on the seas, the two services necessarily co-operated with and supplemented each other to a considerable extent in this work of conservation. It became apparent that closer co-ordination and increased efficiency would result from the union of both services in one organization. The result is the present Coast Guard.

GETTING READY A SUBMARINE MINE WITH DRY GUN COTTON

The duties of the Coast Guard are so many and various that its own most condensed report requires three hundred and ten closely printed pages. It saves life at sea and assists wrecked persons. It cares for mariners in distress and boards ships and examines papers for violations of law. It seizes vessels violating the law or makes report of such violation, patrols regattas, removes derelicts, saves property, enforces neutrality, patrols for ice and protects seals. It warns vessels of danger, recovers and buries bodies cast up, fights forest fires, and fires in wharves and shipping. It helps maintain public order, apprehends law breakers and prevents suicides. It recovers stolen property, restores

CUTTERS PUMPING OUT A WATERLOGGED BARK STRANDED AT LOST HARBOR, ALASKA

lost children to parents, furnishes transportation to other branches of the public service and acts as pilot in cases of emergency. So active is this splendid service that during the year just passed there were but five days when some unit of the service was not actively engaged in wreck or rescue work and the average day's work was the rendering of assistance of some variety in more than six cases.

All that a marine police patrol can do, the Coast Guard does; all that a Life Saving Service can do, the Coast Guard does.

The Coast Guard possesses 24 cruising cutters, 18 harbor cutters, and 279 coast stations. The activities of the year resulted in the saving of 1,507 lives, and the saving of vessels and cargoes valued at $11,088,730, as well as 556 cases of assistance rendered not catalogable as of either life or property.

The total expenditures for both branches of the Coast Guard totaled $5,027,752.71. Other Government departments and Bureaus occasionally return a surplus to the Treasury—the Post Office has done so and the Patent Office does so regularly. But

A STANDARD SURF BOAT LAUNCHED THROUGH BREAKERS
A COAST GUARD STATION AND LIFE BOAT AT SQUAN BEACH, N. J.

no matter how valuable in money the saving effected by other Governmental activities may be, few if any bureaus can point to so clean cut a record as this actual rescue work of property, otherwise a total loss, valued at more than *twice* the cost of the whole service, and throw in the lives saved of the population of a small town for good measure!

It is the business of a Coast Guard cutter to get rid of derelicts whenever they are encountered, and frequently their duty to hunt up

BLOWING UP A SUNKEN MENACE TO NAVIGATION BY MEANS OF SUBMARINE MINES

derelicts reported. Last year 26 were either blown up or towed to port and turned over to their owners, involving the saving of $161,000 in property and saving who knows what lives or property in preventing these obstructions to navigation from doing damage.

The enforcement of the navigation laws led to the boarding and examination of 24,817 vessels during the year, resulting in 772 reports for law violations, involving fines totaling $220,500. Thirty-seven race courses were patrolled, for the protection of life and property. The fur seal patrol in the North Pacific and Bering Sea is in the hands of the Coast Guard, which keeps three vessels on duty during the summer months, and two do ice patrol duty to locate icebergs and field ice in the Atlantic steamship lines, to give warnings to trans-Atlantic vessels and prevent loss of life and property.

The Coast Guard has its own academy, located at New London, Connecticut, where, after severe competitive examinations, young men are given a course in training which compares not unfavorably with both Annapolis and West Point, including practice cruises upon the cutter "Itasca."

In addition to its other work, the Coast Guard works in conjunction with the Board of Life Saving Appliances, which considers new inven-

tions and devices and makes recommendations as to their adoption or development.

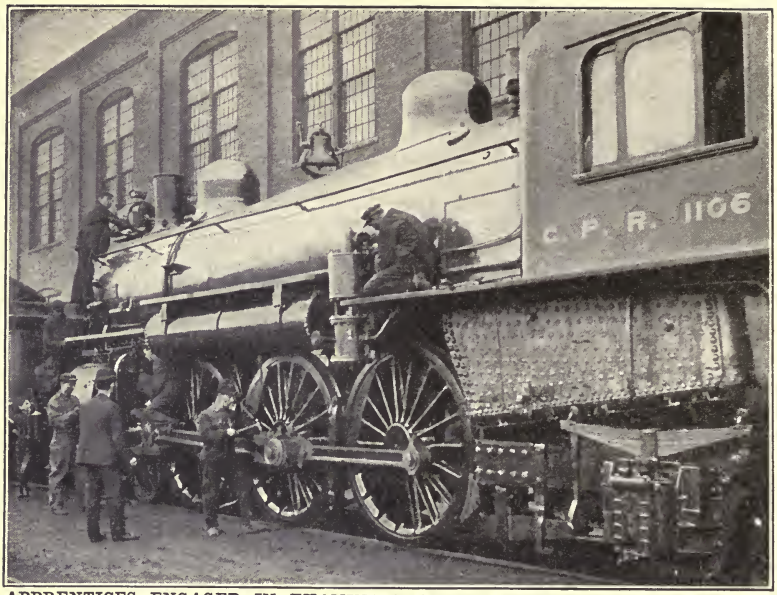
It is not to be expected that in every case where a wreck occurs or assistance is rendered, a complete success can be had. But the proportion of lives saved over lives lost is very large. During the year just passed, 84 disasters within the scope of the service were attended with loss of life. In every such case, according to law, an immediate investigation was made, with the inspiring result that in no case was loss of life chargeable to negligence or failure of the service, but to circumstances beyond human control.

It would require more pages than there are words here available to describe in detail even the more important accomplishments and activities of the Coast Guard, but the following summary perhaps represents its work as well as it is possible to do in tabular form.

DIVER FROM CUTTER DESCENDING TO OLD DOMINION S.S. "MONROE"

COAST GUARD WORK FOR YEAR ENDING JUNE 30, 1915.

Lives saved or persons rescued from peril		1,507
Persons on board vessels assisted		10,952
Persons in distress cared for		813
Vessels boarded and papers examined		24,817
Vessels seized or reported for violation of law		772
Fines and penalties incurred by vessels reported		$220,500.00
Regattas and marine parades patrolled, in accordance with law		37
Vessels to which assistance was rendered		1,504
Instances of miscellaneous assistance		556
Derelicts and obstructions to navigation removed or destroyed		26
Value of vessels assisted (including cargoes)		$10,927,730.00
Value of derelicts recovered and delivered to owners		$161,000.00
Appropriations for 1915, including repairs to cutters and establishing stations:		
Revenue-Cutter Service	$2,536,716.25	
Life-Saving Service	2,550,525.36	$5,089,241.61
Net expenditure for maintenance for 1915:		
Revenue Cutter Service	$2,530,371.17	
Life-Saving Service	2,497,381.54	
Total for Coast Guard		$5,027,752.71



APPRENTICES ENGAGED IN EXAMINING A LOCOMOTIVE UNDER COMPETENT INSTRUCTION

AN AIR BRAKE INSTRUCTION CAR

CHAPTER XII.

RAILROADS OF THE UNITED STATES

WITH the exception of the agricultural and manufacturing industries, the railroads of the United States occupy the attention of a larger number of people and give employment to more men than any other industry.

To consider so vast a subject in a short space it is necessary to separate it into only its most important divisions. This chapter, therefore, will deal with the railroads of the United States under headings of "Physical Aspects," "Financial," "Public Service," "Human Relations," closing with a short reference to the street railways of the various cities of the country.

There are altogether in the United States 899 railroad companies. These are divided, both by the Interstate Commerce Commission and by common consent of all railroad men, into three classes. Class I. includes the 183 railroads which have operating revenues in excess of one million dollars, Class II. includes the 285 railroads which have operating revenues less than one million dollars, but more than one hundred thousand dollars, and Class III. includes the 431 railroads which have operating revenues of less than one hundred thousand dollars.

THE ARCHITECTURE OF THE PENNSYLVANIA TERMINAL AT NEW YORK IS MOST IMPRESSIVE

The majority of the statistics discussed in this chapter are of roads of Class I. only. These Class I. roads, however, are vastly in the majority as far as mileage and importance are concerned. Of the approximately 266,000 miles of track, 229,000 of it is operated by Class I., 20,000 by Class II., and from 16,000 to 17,000 by Class III.

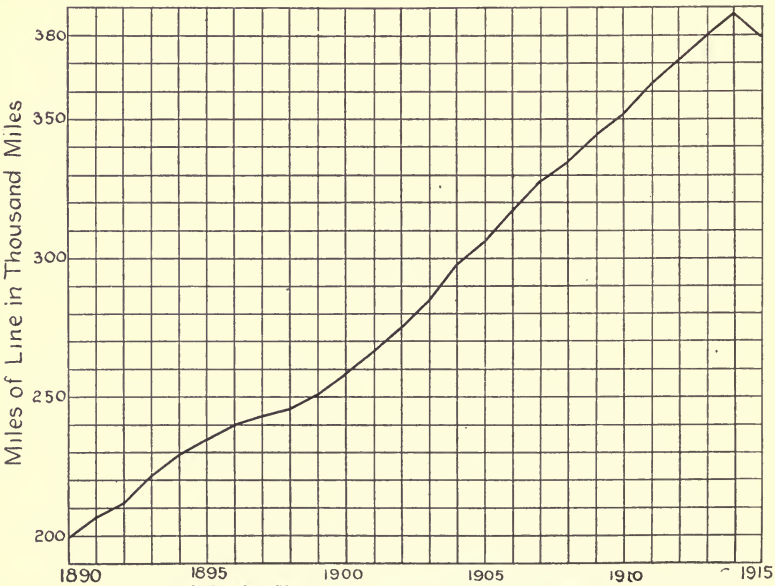
Statistics for this chapter have been gathered from many sources, the principal ones being the reports of the Interstate Commerce Commission, the reports of the Bureau of Railway Economics, and the reports of the Bureau of Railway News and Statistics. Inasmuch as these three statistical gathering organizations frequently cover the same subject by statistics from a dissimilar number of sources, they do not always agree in detail, but, in the main, they agree in almost every particular.

PHYSICAL ASPECTS

Track

Four hundred and forty-eight operating companies, including all of Class I. and almost all of Class II., render reports covering 247,312 miles of track, of which 1,913 miles go through Canada and 52 miles into Mexico. Of this mileage 11,000 miles were operated under trackage rights, leaving 236,600 miles as the real physical mileage of the country. On a basis of the 1914 reported population of 98,372,266 this means that for every 390 people in the United States there is a railroad mile of line.

Railroad construction in this country is on the decrease rather than the increase. Eight hundred and ninety-eight miles were built in 1915 against 1,531 miles in 1914. These figures are for main line tracks. Including auxiliary tracks, sidings, etc., 1,319 miles were built in 1915 as against 2,120 built in 1914. This new construction was the smallest within half a century and reflects in a most comprehensive manner the effect of the industrial depression resulting from the European War on this country in 1915. Since the panic of 1893, the largest railway mileage was built in 1902, when over 6,000 miles of new track was constructed. The total track constructed since 1893, including 1915, is 81,529 miles.



RAILWAY MILEAGE OF THE UNITED STATES

The apparent decrease in 1915 is due to the use of figures from private sources, official figures not being available. See page 147

The most recent official figures are those of the Interstate Commerce Commission for 1914, which gives for the whole country a total of all tracks of 387,208 miles. This includes yard tracks, sidings, fourth, third, second and single track as well as main line mileage. The 1915 statistics, gathered by private sources make the total for the country 379,344 miles, including the same tracks as are given in the Interstate Commerce Commission figures.

THE SAFETY FIRST TRAIN OF THE B. & O.
Shows the possibility of the railroad for exhibition purposes.

LOCOMOTIVES

Upon these miles of tracks there are running to-day upward of 65,000 locomotives. These engines possess tractive power of 2,004,321,000 pounds, a weight so inconceivable that only a comparison can make it evident. If it were possible to hang at the end of a long rope, passing over a pulley, as many huge ships as would balance the pull in pounds of these locomotives *it would require more than twenty-one vessels each the size and displacement of the ill-fated "Lusitania" to equal the combined effort of the locomotives of the United States!*

In addition to the steam locomotives there are 301 electric locomotives operating upon steam roads in the United States. These are of all sizes, but it is of interest to note that the world's largest and most powerful freight locomotive is driven by electricity. It is used to haul trains over the Rockies from Montana into Idaho and the electricity used is generated by water power. The length of the locomotive is 112½ feet and it weighs 284 tons. Compare this to the average weight in tons of the steam locomotives of the United States, which in 1915 was 84.2 tons.

CARS

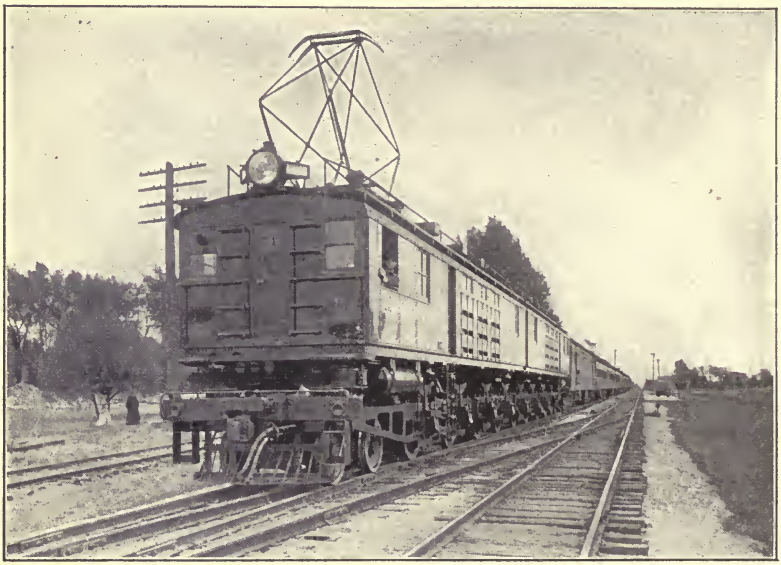
The locomotives of the United States haul 54,378 passenger cars and 2,362,914 freight cars. These have a capacity of 94,995,821 tons, an average of 40.2 tons per car. It is interesting to look back to the census of 1902 and find that in that year the average ton capacity of a car was but 28. Of the passenger cars 10,841 are all steel construction, 4,334 steel underframe, and 39,203 cars are yet of wood construction. The total seating capacity of all passenger cars is 2,277,438, an average of 56 passengers per car.

While the value of equipment, of course, varies widely with the roads buying it and the service for which it is adapted, it may be interesting to note the prices paid for equipment. A locomotive, in 1913, of average size and hauling capacity cost $23,135, a chair car $11,580, a parlor car $17,019, a dining car $20,227, a coach $12,369, a baggage car $11,185, a mail car $16,901, and a café car, $18,381. This would make the total price of a train so made up $130,797, although, of course, few, if any, trains have so many varieties of rolling stock between engine and rear.

To the average traveler the passenger car and baggage equipment is the important thing. To the country as a whole, however, the freight cars are the vital element in railroad operation.

To the public all freight cars are freight cars pure and simple, but to the railroad man they are divided into box cars, flat cars, stock cars, coal cars, tank cars, refrigerator cars and others. Of the freight cars in use in 1914 by Class I. and Class II. roads more than one million were box cars, 146,000 were flat cars, 82,900 were stock cars, 900,000 were coal cars, 8,500 were tank cars, 48,800 were refrigerating cars, and miscellaneous cars made up the balance of 97,000.

Just how important freight cars are to this country is more easily illustrated by a comparison of the cars abroad than in any other manner. In twenty-four countries of Europe there are 369,911 passenger cars against 54,378 in this country. In the same twenty-four countries there are 3,443,532 freight cars against 2,362,914 freight cars in the United States. Passenger traffic is apparently much more important in Europe than it is here, or perhaps it would be more truthful to say that our huge territory and vast expanse



A SPLENDID EXAMPLE OF ELECTRIFICATION ON A TRUNK LINE, C., M. & ST. P.

makes transportation of goods by train a more vital necessity here than anywhere else in the world.

FINANCIAL

The money invested in railroads, the dividends paid, the gross and net income, the wages and salaries disbursed, form such incredible sums that only a real appreciation of the vastness of this country can make their comprehension possible.

Perhaps the most amazing facts are found in a comparison of American financial statistics with those of Europe. Travelers have so dinned it into the ears of Americans that as a nation we are spendthrifts and extravagant that it comes with the force of a decided shock to learn how far we have beaten the older countries in railroading.

MILE COST

According to 1914 statistics, America had 244,253 miles of railroads as against Europe's 198,554. The capital cost of European lines was $25,059,644,889, while America paid but $15,917,192,925. These figures reduce to $126,211 as the cost per mile of line for Europe, which includes not only the low cost of railroads of Norway and Sweden, but the exceptionally high costing and magnificent road beds of England. The United States figures reduce to $65,166 per mile of line. In other words, we have some thirty per cent greater mileage at some forty per cent less cost than Europe, and these are facts in face of a scale of wages double that of the European standard, and higher rates for borrowed money.

CAPITALIZATION

According to the "Bureau of Railway News and Statistics," 448 operating companies, covering 247,312 miles of line, of which 188,247 were owned and 59,065 miles were leased, reported a capitalization as given at the bottom of the page.

NEW CAPITAL

In 1914 over $300,000,000 of new capital was invested in extensions, improvements and new construction. But 1915, a year of great uncertainty due to conditions abroad, saw less than $100,000,000 similarly employed. What 1916 will show is as yet unknown, but with the tremendous increase in the business of this country and the almost unprecedented call for transportation facilities, it is scarcely to be doubted that much new financing will be arranged.

VALUATION OF RAILROADS

When Congress appropriated $50,000,000 to conduct an inquiry into and to establish the actual physical valuation of American railroads, many uninformed people dubbed the national legislature wildly extravagant. But four years have passed, the end of the work is nowhere in sight, and it may well not arrive

CAPITALIZATION OF 448 COMPANIES OPERATING 247,312 MILES OF LINE IN 1915

Capital stock	$7,277,410,880	
Funded debt	10,466,465,240	
Receivers' certificates	52,362,863	
Total 188,247 miles owned		$17,796,238,983
Rental 59,065 miles, $116,852,303½ at 4½		2,596,717,844
Total 247,312 miles operated		$20,392,956,827
Deduction:		
Railway stock owned	$2,716,852,149	
Funded debt owned	1,970,496,754	
Miscellaneous securities owned	2,525,950	4,689,874,853
Net capitalization, 1915		$15,703,081,974
Net capitalization per mile operated		63,495
Net capitalization per mile of track (379,344)		41,393

until an additional appropriation is made.

While no very exact figures are obtainable, it is doubtful if the present actual value of American railways can be much less than the unthinkable sum of $22,000,000,000, which would certainly not bear out any charges of over-capitalization. Moreover, official figures of valuation of railroads within certain areas, conducted by several States, go far to prove that roads are anything but over-capitalized. For instance, State valuations made in Washington (1905) gave the cost of reproduction as 194 millions, capitalization 161 millions. South Dakota (1908) cost of reproduction 106 millions, capitalization 109 millions. Minnesota (1907) cost of reproduction 360 millions, capitalization 300 millions. Wisconsin (1909) cost of reproduction 296 millions, capitalization 225 millions. Nebraska (1911) cost of reproduction 327 millions, capitalization 263 millions. New Jersey (1911) cost of reproduction 374 millions, capitalization 333 millions.

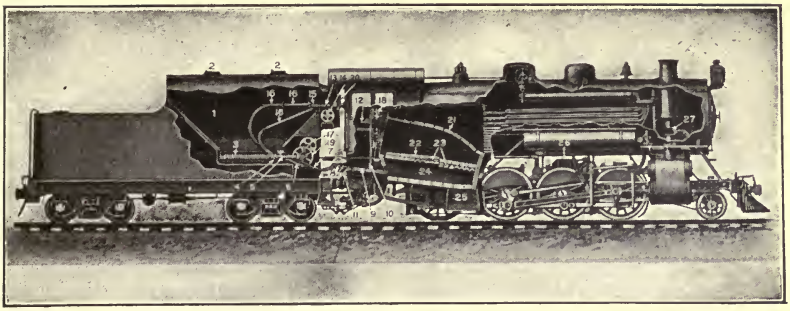
WHO OWNS THE RAILROADS

Railroads are owned in two ways —by those who purchase or otherwise become possessed of stock, and those who lend money to buy, build, or extend railways, by the purchase of bonds. In the final analysis, a railway is owned by its stock holders, who owe the money represented by the outstanding bonds to the bond holders, but for ordinary purposes of comparison a bond holder is a part owner of a railroad, since his interest charges have a claim on earnings prior to the stock dividend claim. An exact census of stock holders is not a possibility, for many reasons, one of them being the frequent (hourly) changes in ownership. But according to the best reports obtainable, there are some 623,000 stock holders for American railroads, a figure almost double that of the Interstate Commerce Commission for 1182 roads in 1904.

It would be wearisome to report stock holders and increase for every road in the United States, but those for twenty of the great roads, show-

STOCK HOLDERS IN TWENTY PRINCIPAL AMERICAN RAILWAYS, 1904 TO 1915

Name of Company	Share holders	
	1904	1915
Pennsylvania R. R.	44,175	93,332
Atchison, Topeka & Santa Fe	17,823	42,738
New York Central and Hudson River	11,781	25,446
New York, New Haven & Hartford	10,842	26,589
Union Pacific	14,256	30,970
Great Northern	383	22,103
Southern Pacific	2,424	32,143
Northern Pacific	368	20,413
Chicago, Milwaukee & St. Paul	5,832	19,230
Baltimore & Ohio	7,132	36,568
Illinois Central	9,123	10,963
Erie	4,309	5,868
Chicago & North-Western	4,109	10,394
Boston & Maine	7,402	8,076
Norfolk & Western	2,911	8,815
Delaware & Hudson	3,819	7,137
Denver & Rio Grande	2,910	4,618
Missouri Pacific	1,861	6,972
Chesapeake & Ohio	1,478	6,604
Louisville & Nashville	1,672	4,703
Total	154,610	423,682
Increase since 1904, per cent		174.0%



A POWDERED COAL BURNING LOCOMOTIVE

ing the increase from 1904 to 1915, are given on page 150.

Figures for railway bond holders are not obtainable, although the Comptroller of the Currency reported in 1913 that more than eleven hundred millions of stocks and bonds together were held by savings banks, State banks, private banks and loan and trust companies as assets.

INCOME AND EXPENDITURE

Railroad bookkeeping is so intricate a subject and railroad financing is so involved a matter, requiring experts who spend years in the work for its thorough comprehension, that only general figures can be gone into here. The Bureau of Railway Economics summarizes the income account as on page 152, including only Class I. roads.

MISCELLANEOUS FINANCIAL

The railroads of the United States pay a generous proportion of the nation's taxes. The official figures for 1914 show that the huge sum of $140,531,575 was turned into the various treasuries from all the railroads, a percentage of 4.61 of the earnings. The taxes amount to $572 per mile of road, more than double the tax of 1900 and almost three times the tax of 1890 when $199 was the tax per mile. The relative proportion of tax to earning capacity, however, has not risen so fast. In 1890 2.96 per cent of earnings were paid in taxes, while in 1914 the amount had only increased to 4.61 per cent as above. In New Jersey railroads pay $3,068 per mile of line, in South Dakota but $255.

It is interesting to compare the relative prices paid for fuel and the amount expended during the last fifteen years, for the measure of fuel used is a measure of the power expended. Unofficial figures for 1915 place the cost of locomotive fuel at

HELL GATE BRIDGE, OVER THE EAST RIVER, LONGEST ARCH BRIDGE YET BUILT

$215,359,532, which is considerably less than the official figures for 1914, which are $242,800,799. Fifteen years ago but $90,593,965 was paid for fuel, although the cost of coal per ton at the mine was $1.04 in 1900 and but $1.18 in 1914. The 1915 cost was less, compared with operating expenses, than at any time for fifteen years, which may indicate that the new campaign for economy of operation and coal saving has had a visible effect.

THE RAILROAD'S MONEY

Every one hundred dollars a railroad receives comes from the sources shown on page 153.

PUBLIC SERVICE

Passengers

There are upwards of 3,000,000 square miles of territory in the United States and more than 100,000,000 people. If every man, woman and child in the United States had taken a journey in 1915, according to unofficial figures, that journey would have been one of slightly more than 33.6 miles. According to the Interstate Commerce Commission figures for 1914, the

RAILWAY INCOME, FISCAL YEAR, 1915:	
Railway operating revenues	$2,870,913,815
Railway operating expenses	2,020,823,953
Net operating revenue	850,089,862
Railway tax accruals	133,219,085
Uncollectable railway revenues	649,921
Railway operating income	716,220,856
Miscellaneous operating income	1,874,357
Total operating income	718,095,213
Non-operating income	237,368,878
Gross income	955,464,091
Deductions from gross income:	
Interest on funded debt	386,483,143
Interest on unfunded debt	28,401,357
All other deductions	227,589,566
Total deductions	642,474,066
Net income	312,990,025
Disposition of net income:	
Dividend appropriations	169,563,440
Income appropriated for investment in physical property	20,807,042
Other income appropriations	12,890,736
Total appropriations of income	203,261,218
Balance to credit of profit and loss	109,728,807

The source of revenue and the disposition is shown in the following table:

RAILWAY OPERATING REVENUES, FISCAL YEAR, 1915:	
Freight	$1,977,402,839
Passenger service train revenue	783,401,352
Passenger	629,155,489
Mail	56,949,414
Express	68,942,809
All other rail-line transportation	36,718,310
Total rail-line transportation	2,797,522,501
Water line transportation	13,034,648
Incidental operating revenue	58,089,968
Joint facility credit balance	2,266,698
Total operating revenues	$2,870,913,815

RAILWAY OPERATING EXPENSES, FISCAL YEAR, 1915:	
Maintenance of way and structures	$363,902,819
Maintenance of equipment	496,666,194
Traffic	59,394,183
Transportation—rail-line	1,002,619,070
Transportation—water-line	8,173,995
Miscellaneous operations	22,869,188
General expenses	74,143,669
Transportation for investment—Cr.	6,945,165
Total operating expenses	$2,020,823,953

average journey per person was 33.61 miles for Class I. and II. roads only.

The 32,327,466,000 theoretical passengers who were carried one mile in 1915 each paid 2,023 cents for the privilege, and the 277,232,653,000 tons of freight, also carried one mile, cost 7.38 mills per mile for the hauling!

The table on page 154, aranged by the Bureau of Railway News and Statistics, gives the official figures for 1914 and the unofficial figures for 1915 of both freight and passenger service.

In 1915, 961,000,000 passengers were carried. Passenger trains rolled up the enormous mileage of 607,000,000—a distance which would carry a passenger three and one-quarter round trips to the sun and back again! There were an average of 53 passengers to every passenger train, and the nine million and some passengers paid enough to make a passenger revenue of $654,000,000, more than double the revenue of fifteen years ago and at only a minute increased cost per mile, the 1900 figures being $0.0203 per mile.

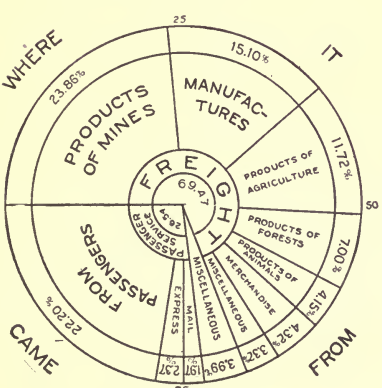
THE RAILROAD DOLLAR

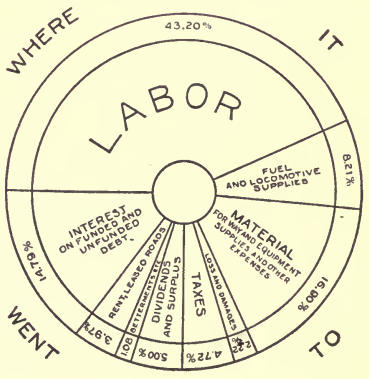
Where it comes from:

Passengers	22.20
Products of Mines	23.86
Manufactures	15.10
Products of Agriculture	11.72
Products of Forests	7.00
Products of Animals	4.15
Merchandise	4.32
Miscellaneous freight	3.32
Mail	1.97
Express	2.37
Miscellaneous	3.99

Every one hundred dollars a railroad disburses is spent for these purposes in these amounts:

Labor	$43.20
Fuel and locomotive supplies	8.12
Material	16.90
Loss and damages	2.22
Taxes	4.72
Dividends and surplus	5.00
Betterments	1.08
Rent of leased roads	3.97
Interest	14.79





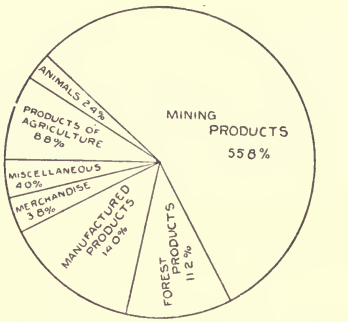
FREIGHT

In 1914, Class I. and II. roads moved 85,555,053 tons of the products of agriculture, 23,763,262 tons of animals, 539,255,980 tons of mining products, 108,506,272 tons of forest products, 135,175,536 tons of manufactured products, 36,519,321 tons of merchandise and 38,447,567 tons of miscellaneous freight.

These statistics show the somewhat curious result that over 55 per cent of freight moved in this country is from mines and that both forest products and manufacturing products form a greater percentage of the weight moved than do agricultural products. Reducing to a unit basis official figures show that in 1914, there were 288,319,890,210 tons of freight carried one mile, equivalent to the transportation of a fleet of *Lusitanias* numbering 6,864,759; in other words, an unthinkable number.

MAIL AND EXPRESS

In addition to the public service of moving passengers and freight, the railways haul the mail and the express, two activities which are at the very bed rock of modern business. The nation pays to the railroads the sum of $57,973,106 yearly (1915 figures, Bureau of Railway News and Statistics) for carrying the mail, and the express companies $69,784,468 for carrying express, a figure by the way, which is declining

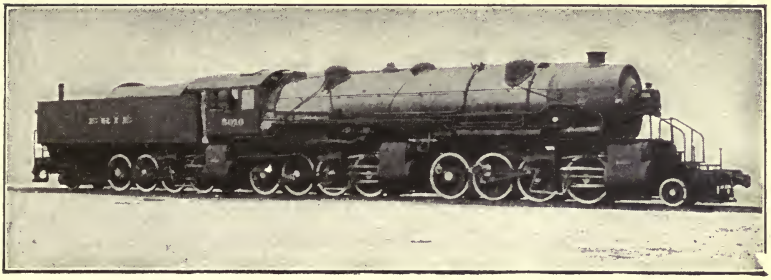


CLASS OF FREIGHT MOVED, 1914

COMPARATIVE SUMMARY OF PASSENGER AND FREIGHT SERVICE FOR THE YEARS ENDING JUNE 30, 1915 AND 1914

	1915 Bureau Figures	1914†* Official Figures
Miles Represented	247,312	245,624
PASSENGER SERVICE		
Passengers carried	961,351,000	1,053,139,000
Passengers carried 1 mile	32,327,466,000	35,258,498,000
Passengers carried 1 mile per mile of line	130,715	144,278
Mileage of revenue passenger trains	572,103,000	602,388,000
Average number of passengers in train	56.5	56
Average journey per passenger, miles	33.6	33.61
Passenger car miles	3,203,881,000	3,393,283,000
Average passengers per car	10.09	10.39
FREIGHT SERVICE		
Number of tons reported carried	1,779,512,000	1,976,138,000
Tons carried 1 mile	277,232,653,000	288,319,890,000
Tons carried 1 mile per mile of line	1,120,983	1,176,923
Mileage of revenue freight trains	548,363,000	605,923,000
Average number of tons in trains	505	452
Typical haul of average railway, miles	156	146
Mileage of revenue mixed trains	35,022,000	32,565.000
Total revenue train mileage	1,155,489,000	1,242,080,000
Total mileage freight cars	19,935,455,000	20,796,895,000
Average tons per car (loaded and empty)	13.55	13.86
Total locomotive miles	1,562,839,000	1,689,748,000

† Exclude returns from switching and terminal companies, included in 1915, 1914
* Class I. and II. only



TRIPLEX COMPOUND LOCOMOTIVE—ARTICULATED MALLET TYPE—ERIE RAILROAD
(Built by Baldwin Locomotive Works)

yearly, due to the expansion of parcel post.

HUMAN RELATIONS

If we consider the average family as consisting of three people, then there are 33,333,333 adult males in the United States. One man in every nineteen is a railroad employee.

EMPLOYEES

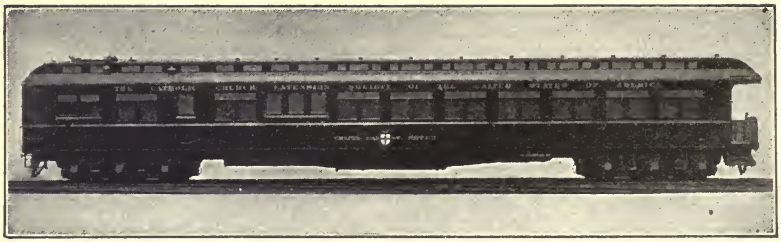
According to the official figures for 1914, there are 1,695,483 persons employed by the railroads, or 685 employees for every mile of line. These include for each mile of line 6 general and other officers, 35 clerks, 15 station agents, 66 station men, 25 engineers, 26 firemen, 19 conductors, 55 other trainmen, 23 machinists, 29 carpenters, 103 shopmen, 18 section foremen, 135 trackmen, 15 switch tenders, crossing tenders and watchmen, 16 telegraph operators and dispatchers and 99 other employees.

COMPENSATION

The railroads disbursed in 1914 $1,373,422,472 to all employees. Of the employees receiving this huge sum—about what it cost to run the United States Government, including the army and navy—the general and other officers, of course, received the largest average daily compensation, of $8.40.

Next highly paid are the engineers, with an average daily wage of $5.24, followed by conductors, average daily wage $4.47; machinists, average daily wage $3.27; firemen, average daily wage, $3.22; trainmen, average daily wage, $3.09, down to trackmen with an average daily wage of $1.59. It is a peculiar commentary on the disproportionate relation between responsibility and pay, to learn that the average daily wage of carpenters in railroad work is $2.66 and that of telegraph ope-

REPLICA OF THE "DE WITT CLINTON," POSED BEFORE THE MOVING PICTURE CAMERA. THE ORIGINAL WAS THE THIRD LOCOMOTIVE IN AMERICA



A TRAVELING CHAPEL ON WHEELS. CHAPEL CAR "ST. PETER"

rators and dispatchers but $2.56.

According to well digested statistics, in 20 years the pay of engineers has increased 45 per cent, firemen 58 per cent, conductors 47 per cent, other trainmen 63 per cent. The average pay per year of railroad employees of all classes is $825, with a road passenger engineer averaging over $2,000, a road passenger fireman averaging over $1,200, and a road passenger conductor averaging over $1,700 per annum. Altogether twenty-two classes of employees receive over $1,000 a year.

FOREIGN PAY

The question is of intense interest to the general public, because of the effect upon the public of railroad labor dissatisfaction, and the economic effect of strikes. Without going into any controversy between employees and roads or in any way taking sides, it is nevertheless interesting to compare conditions here with those abroad. In this country, let it be noted, the ratio of compensation paid employees to gross earnings is 43 per cent. The ratio of compensation of employees to the operating expenses is 61 per cent and the total ratio of all expenses and taxes to gross earnings is 75 per cent. Now compare with the table on page 158.

ACCIDENTS

The American people have become so accustomed to frightful railroad accidents that they have accepted largely without question the statements too often made that no railroads are so unsafe as those of the United States. In the year 1915, 325 railroad companies operated 161,948 miles of line, according to the Bureau of Railway News and Statistics, *with absolutely no fatalities to passengers in train accidents.* This mileage is very nearly that of Europe excluding England. To carry 18,083,050,000 passengers a mile and kill none of them is a real record.

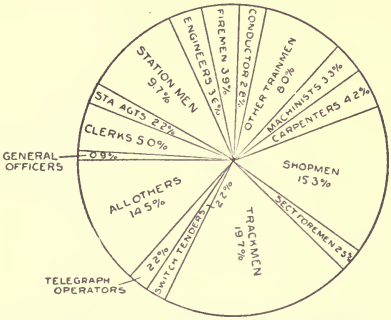
In 1891 the United States had 161,275 miles of road, carried 531,183,998 passengers and killed 110 of them. In 1915, roads operating a greater mileage, with 40 per cent

ROMAN CATHOLIC CHAPEL CAR

more traffic and double the freight traffic, killed *none*. Three companies have a flawless record for twelve years, 23 for eleven years, 39 for ten years, 48 for nine years, 63 for eight years, 77 for seven years, 87 for six years, 107 for five years, 136 for four years, 178 for three years, 232 for two years, and 11 companies in 1915, 23 in 1914, and 15 in 1913 killed only *one* passenger *each*.

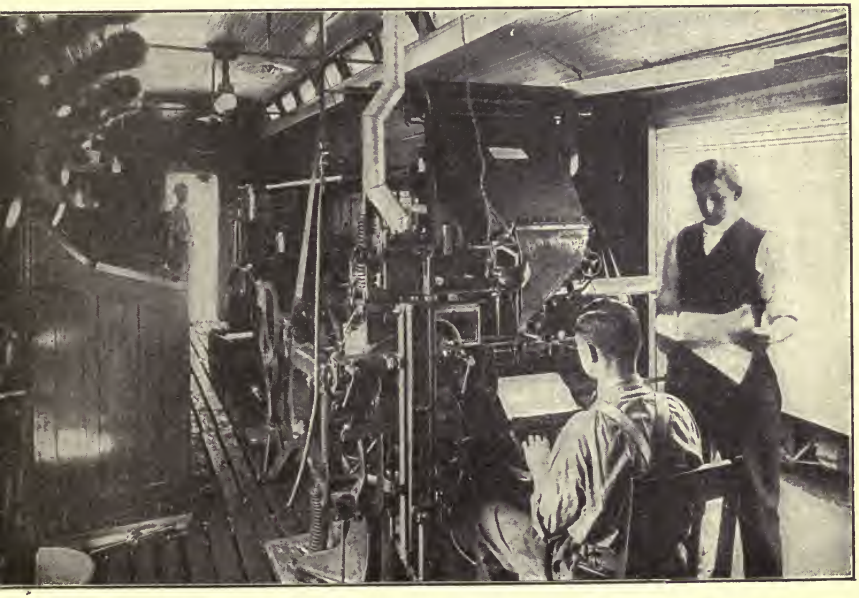
On all roads and in all ways, there were 196 passengers killed and 10,279 injured in 1915. Employees on duty were killed to the number of 1,594 and 38,060 were injured. Two hundred and fifteen employees not on duty were killed and 840 injured, and trespassers, persons not trespassers but not connected with or traveling upon railways and railroad industrial accidents not involving train operation made up the balance of the grand total of 8,621 persons killed and 162,040 injured.

If you want to know exactly what



PERCENTAGE OF EMPLOYEES PER MILE OF LINE

your chances are of being killed in a railroad accident, supposing future conditions are similar to those



A NEWSPAPER PLANT INSTALLED IN A BAGGAGE CAR

A complete photo-engraving plant, composing and pressroom was provided. This was the publicity car for an automobile tour

SUMMARY SHOWING NUMBER OF EMPLOYEES COMPENSATION AND AVERAGE YEARLY PAY OF THE PRINCIPAL EUROPEAN COUNTRIES AND OF JAPAN

Country	Miles of Railway	Employees, Number	Compensation per year	Average per year	Ratio to Revenues
*United Kingdom (1913)	23,691	‡643,135	$170,028,613	$279	27.2
German Empire (1913)	37,894	786,466	321,639,536	409	38.0
Austria (1912)	14,185	280,220	92,439,338	330	40.1
Hungary (1912)	13,303	147,194	44,218,935	300	38.3
Russia (1910)	41,622	771,938	163,149,009	211	32.7
France (1908)	24,915	442,709	115,125,400	260	34.4
Italy (State, 1912)	8,387	148,569	52,657,655	354	45.2
Switzerland (All, 1913)	3,148	45,386	16,697,901	368	33.5
†Denmark (State, 1914)	2,333	13,198	4,644,727	352	30.7
Sweden (1912)	8,659	48,330	18,578,561	384	42.8
Roumania (1914)	2,200	34,422	8,523,168	248	38.4
Belgium (State, 1911)	2,926	70,364	17,991,907	256	29.7
Japan (1914)	5,348	112,087	12,655,621	113	22.3

* Of British railway employees, 49,584 are classed as boys, and the compensation does not include administrative staff.

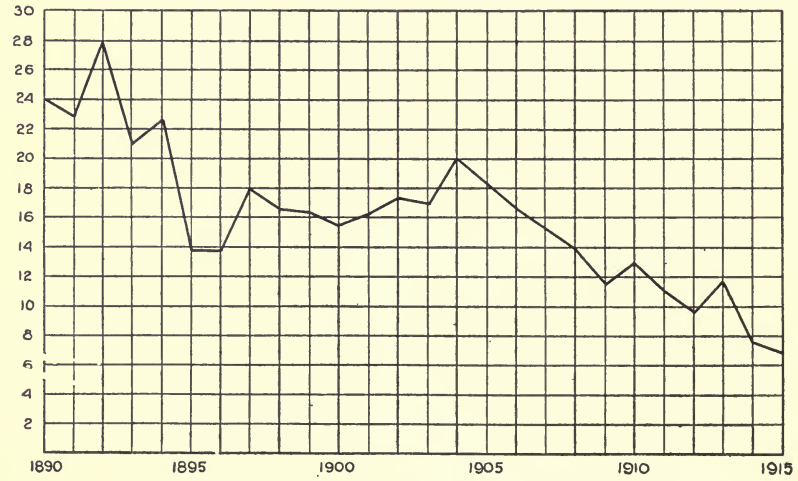
† Excludes laborers.

‡ Census 1913, latest reported.

of 1915, the method is simple enough. As there were 389,487,542 passengers carried a mile in safety for every one killed in 1915, merely divide that number by the miles of your journey to find your proportionate chance. Thus, if you happen to be going a distance of 389 miles, your chances are just one in a million of being killed. Ask any accident insurance company what the hazards are in walking a city's streets and see how safe American railroads really are!

STREET RAILWAYS

The term is inclusive of what is commonly known as trolley line de-



DEATH PER BILLION PASSENGER MILES

THE FALLING RATE OF FATALITY IN AMERICAN RY. TRAVEL

THE HAZARDOUS LIFE OF A RAILROAD LINEMAN

velopment and the statistics given include not only city and suburban but interurban electric roads. The authority is the United States Census for 1912, which provides the most recent facts obtainable for the industry.

Nine hundred and seventy-five operating companies control 41,064 miles of track. Of this mileage 38,958 miles are for overhead trolley, the balance being conduit and all other forms of electrical propulsion including storage battery and third rail.

City and suburban lines utilize 24,699 miles of track and interurban roads 16,365 miles.

In 1912 these roads carried 12,135,341,716 passengers. Not all these produced revenue, 2,423,918,024 riding on transfers and 165,869,025 being carried free.

The street railways possess 94,016 cars, of which 76,162 are passenger cars, 7,794 are express, freight, mail and baggage cars, and 10,060 work cars, snow plows, sweepers, etc.

Two hundred and eighty-two thousand four hundred and sixty-one employees of all sorts have a pay envelope holding $200,890,939 per year, and it is worthy of note as showing the tremendous demand for this variety of transportation that the number of people so employed was 100 per cent greater in 1912 than in the previous census of 1902.

The gross income of the 975 companies in 1912 was $585,930,517, of which $51,650,117 was paid out in dividends. It is interesting to note, in view of the agitation for municipal ownership and the cry continually going up that street railways make huge sums of money by crowding cars, that the average passenger revenue is 5.27 cents, of which 3.49 cents must go for operating expenses.

The greatest street railway mileage is in New York State, which possesses 4,605 miles against 4,117 in Pennsylvania and 4,069 miles in Ohio. The least mileage is in New Mexico, which possessed 10.6 miles in 1912, followed by Nevada with 11.27.

Copyright Underwood & Underwood

PAINTING THE BROOKLYN BRIDGE

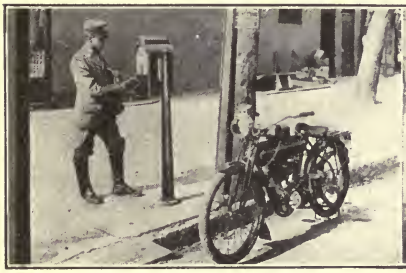
STEEL MAIL CAR READY TO PICK UP A SACK EN ROUTE

INTERIOR OF MAIL CAR

CHAPTER XIII.

THE POSTAL SERVICE

NO part of the United States Government comes into such close and intimate touch with its people as the Post Office Department. No function of our government is more important; indeed, our whole commercial life is bound up with the Post Office, and a failure of the mail service would mean a domestic tragedy compared to which a state of war would be trivial.



THE MOTORCYCLE COLLECTOR CAN COVER GREAT DISTANCES

THE AUTO IS A SPEEDY COLLECTOR

These facts, generally recognized by common consent, have been enacted into laws governing the mail service which make "U. S. Mail" sacred property, and the integrity of the service a national pride.

This is not the place for a historical *résumé* of the service since its formation by the Continental Congress, but a word or two of the development of the system may not be out of place. In 1792 it cost seventeen cents to send a letter the distance between Boston and New York. Boats, stage-coaches, pony express—the means of transportation available meant delays, uncertainty and expense. To-day two cents will carry an ounce of letter to the Philippines, to Alaska, to Porto Rico, to Canada, to Mexico, to Great Britain and some countries of Central and South America, and five cents will take half an ounce anywhere in the civilized world.

Beginning with a pony express for letters only, the Post Office Department has extended its activities to meet the needs of advancing civilization until its ramifications and activities, while clearly defined, have broadened far beyond the mere carrying of letters.

First of these broadening horizons was the registry system by which loss of valuables is practically negligible. City Delivery in all large cities has saved literally billions of dollars worth of time. "Special De-

livery" has saved special time when special time is of great value—and at a minimum cost. This was introduced in 1885—the faint forerunner of another system of delivery which has had most tremendous and far-reaching effects. This, of course, is Rural Free Delivery—the familiar "R. F. D." which has so altered country living conditions as to make them unrecognizable to those who knew them best. Next came the Postal Savings system, and finally Parcel Post, so that our Post Office Department is now a banking institution, an express company, a special carrier, an insurance office, a disseminator of knowledge (second class mail privilege), and an encourager of thrift and business as well as a mere carriage institution for folded pieces of paper.

NUMBER OF POST OFFICES BY CLASSES, JULY 1, 1911 TO 1915

Year	First class	Second class	Presidential Third class	Total	Fourth class	Total
1911	444	1,907	5,643	7,994	51,287	59,281
1912	457	1,940	5,830	8,227	50,502	58,729
1913	485	1,979	5,942	8,406	49,614	58,020
1914	521	2,081	6,044	8,646	48,164	56,810
1915	533	2,138	6,249	8,920	47,460	56,380

POST OFFICES

The numerical facts about our postal system are fairly staggering in their size. We have (Report for year ending June 30, 1915) 56,380 post offices, exclusive of 589 in the Philippines, under War Department jurisdiction, and 14 on the Canal Zone. Post offices are slowly decreasing in number, due to the extension of the R. F. D. service, as shown in the table above.

STAMPS

There are no statistics available for the number of letters transported or delivered, for obvious reasons. But if the total money expended for stamps and stamped paper be considered to have been spent for two cent stamps, then there was purchased and presumably used in 1915 the unthinkable total of 12,801,850,426 two cent stamps, enough for every man, woman and child in the United States to use on 128 letters each during the year!

Of course the $256,037,008.51 received for stamps and stamped paper, which was 92 per cent of the postal revenue, was not all for two cent stamps, but the comparison stands.

SECOND CLASS MAIL

Second class mail, consisting of newspapers and periodicals mailed by the publishers at the uniform rate of a cent a pound for all distances except within the county of publication, where the postage is free, amounted to 1,109,285,785 pounds. Ten *Lusitanias* would not weigh so much, nor would five thousand locomotives, all over the average size used to pull trains! What this service means to us, as an educational matter, is beyond computation.

PARCEL POST

It is impossible to say of any one work of the Post Office Department, "This is the most important." Whether parcel post or second class mail privilege, postal savings or first class mail, foreign mail or R. F. D. is most vital is hardly important here. But certainly the establishment and successful working of the parcel post system is not least important among those great

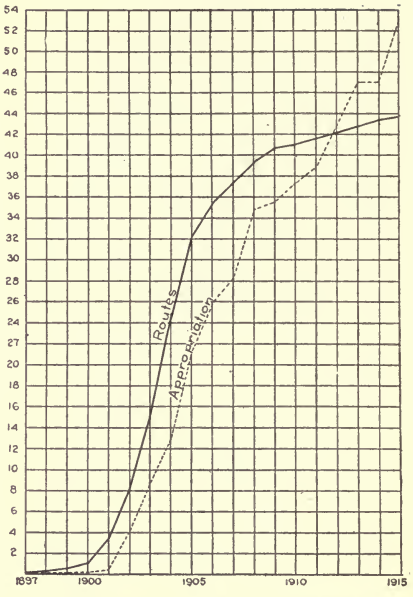
CARRIERS ROUTING UP PARCEL POST FOR DELIVERY
VARIETY OF TEAMS USED IN DELIVERY OF PARCEL POST MAIL

PARCEL POST MOTOR TRUCKS
HORSE-DRAWN LOAD OF PARCEL POST MAIL

improvements the Postal Service has made within recent years.

Exact statistics of parcels carried are not obtainable. To enable the department to ascertain the growth of the service as well as its revenues and costs, periodical counts have been made and detailed information obtained at all first and second class offices and at a number of representative third and fourth class offices of the number of parcels handled, the amount of postage thereon, and the costs of the service. Statistics in the minutest detail are compiled from these data for the 50 largest offices, which represent approximately one-half of the entire postal business. The latest count, from October 1 to 15, 1915, shows that 30,939,730 parcels were mailed at these offices, on which the postage amounted to $1,856,602.82, and the total weight aggregated 41,815,452 pounds.

These statistics indicate that the Postal Service is now handling 1,000,000,000 parcels annually. During the fiscal year 18,000,000 parcels were insured, an increase of 34.78 per cent over the preceding year. The number of parcels sent C. O. D. during the year was over 4,000,000, an increase of 57.66 per cent over the number handled the previous year.



Number of Routes in Thousands
Appropriation in Millions of Dollars

R. F. D. ROUTES AND APPROPRIATION

RURAL FREE DELIVERY

Since its establishment in 1897 the R. F. D. business has grown by

Fiscal Year	Routes	Increase in routes	Appropriation
1897	82	....	$40,000
1898	153	71	50,250
1899	412	259	150,032
1900	1,259	847	450,000
1901	3,761	2,502	1,750,796
1902	8,298	4,537	4,089,075
1903	15,119	6,821	8,580,364
1904	24,566	9,447	12,926,905
1905	32,110	7,544	21,116,600
1906	35,766	3,656	25,828,300
1907	37,728	1,962	28,200,000
1908	39,277	1,549	34,900,000
1909	40,628	1,351	35,673,000
1910	41,079	451	37,260,000
1911	41,656	577	38,860,000
1912	42,199	543	42,790,000
1913	42,805	606	47,000,000
1914	43,652	847	47,500,000
1915	43,877	225	53,000,000

Photo International News Service

CONVEYING MAIL IN A GREAT RAILWAY TERMINAL

leaps and bounds. Begun with eighty-two tentative and experimental routes, it now has close to fifty thousand. Its initial appropriation was $40,000, the present appropriation is $53,000,000, most of which, of course, goes to pay the 43,718 carriers, the average pay of whom is not quite $1,100 annually.

The table on page 164 gives in short form the increase in routes.

POSTAL SAVINGS

In January, 1911, the United States made its Post Office Department a great bank, by beginning the Postal Savings System. By it people of small means are encouraged to save, are provided with a quick and easy means of banking, without any red tape, are assured the safety of their money with all the resources and credit of the United States, and are given the privilege of converting savings into United States bonds without trouble, risk or the payment of premiums.

GROWTH OF POSTAL SAVINGS SYSTEM.

Month	Offices	Branches and stations	Total depositories	Deposits	Withdrawals	Balance to credit of depositors	Increase		Number of depositors	Average principal per depositor	Savings cards and stamps			Balance on deposit in banks
							Amount	Per cent			Sold	Cashed or Converted into deposits	Outstanding at close of month	
Jan., 1911...	48	...	48	$61,805.00	$1,704.00	$60,101.00	.....	....	.....	.....	$980.40	$429.00	$551.40	.....
June, 1911..	400	...	400	316,714.00	34,500.00	677,145.00	$282,214	71.5	11,918	$56.82	1,236.60	690.00	1,887.70	$571,670.90
June, 1912..	9,907	263	10,170	2,961,646.00	1,604,871.00	20,237,084.00	1,356,775	7.2	243,801	83.01	12,666.70	12,657.00	34,020.70	18,586,042.32
June, 1913..	12,158	662	12,820	3,388,147.00	2,626,339.00	33,818,870.00	761,808	2.0	331,006	102.00	10,498.60	10,848.00	40,527.70	31,512,337.46
June, 1914..	9,639	708	10,347	4,128,214.00	3,435,577.00	43,444,271.00	692,637	1.6	388,511	111.82	11,708.50	12,667.00	49,013.80	40,919,673.31
June, 1915..	8,832	714	9,546	5,305,158.00	4,336,396.00	65,684,708.00	968,762	1.5	525,414	125.02	12,791.80	13,336.00	56,206.10	60,086,318.94

On June 30, 1915, postal savings deposits aggregated $65,684,708, a gain of $22,240,437, or 51.2 per cent, compared with amount on deposit at the close of the previous fiscal year. The number of depositors increased from 388,511 to 525,414, a gain of 136,903, or 35.2 per cent.

The growth of the system from the time of its inauguration on January 3, 1911, to the close of the fiscal year ended June 30, 1915, is shown in the table on page 165.

POSTAL SAVINGS BONDS

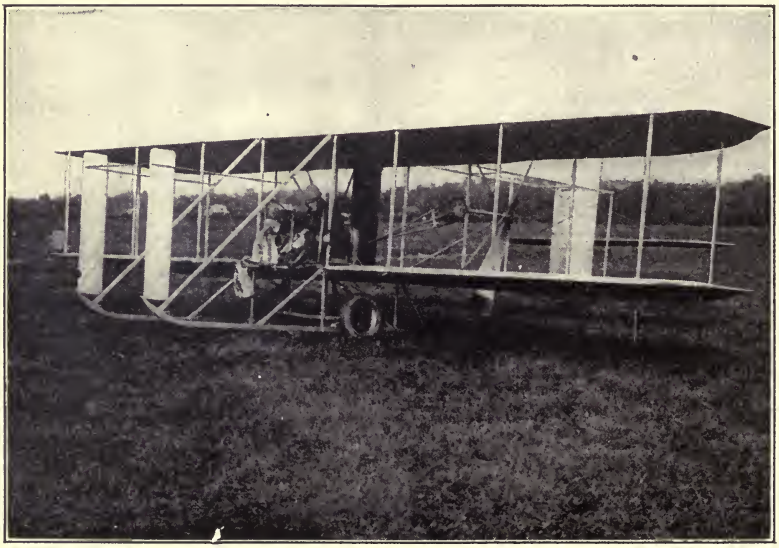
A depositor may exchange deposits in amounts of $20 and multiples for 2½ per cent United States postal savings registered or coupon bonds. Postal savings bonds were issued during the year to the amount of $1,799,040. Since the beginning of the service $6,260,360 in registered and $1,046,740 in coupon postal savings bonds have been issued.

DEPOSITORS

Depositors born outside of the United States constitute 58.7 per cent of the total number of depositors and own $47,161,620, or 71.8 per cent of the total postal savings deposits. Natives of Russia lead with 20.7 per cent of the total postal savings deposits to their credit; follow in order natives of Italy, 14.2 per cent, Great Britain and its colonies 8.8 per cent, Austria 8.7 per cent, Hungary 4.3 per cent, Germany 4.1 per cent, Sweden 2.2 per cent, and Greece, 1.8 per cent. Other foreign-born depositors owned 7 per cent of all postal savings deposits.

RAILWAY MAIL

To handle this part of the subject in a paragraph is an impossibility. Railway post offices are in service on 216,439 miles of lines and travel 322,079,796 miles a year. An army of 34 officers, 114 chief clerks and 19,351 railway clerks accomplished during the year 8,644,285,506 distributions and redistributions of pieces of first-class and 5,212,698,814 dis-



THE TRANSPORTATION OF MAIL BY AEROPLANE IS AN ACCOMPLISHED FACT
Note the Mail Bags

tributions and redistributions of pieces of second, third and fourth-class matter, a total of 13,856,984,320 distributions and redistributions of pieces, exclusive of registered matter, an increase of 3.35 per cent over the previous year.

Of registered matter there were handled and rehandled in transit 57,148,648 packages and cases, 1,643,657 registered pouches, and 792,950 inner registered sacks. In addition, clerks made up and dispatched 1,095,562 registered pouches and inner registered sacks; received and opened 813,266 registered pouches and inner registered sacks; handled and rehandled in transit 2,391,377 registered-package jackets; made up and dispatched 803,779 registered-package jackets, containing 5,505,412 pieces; received and opened 722,517 registered-package jackets containing 5,047,661 pieces; handled and rehandled in transit 122,447 lead-seal sack jackets; made up and dispatched 1,784 lead-seal sack jackets containing 20,265 pieces; and received and opened 11,451 lead-seal sack jackets containing 94,367 pieces.

Of the 13,856,984,320 pieces of mail matter distributed and redistributed, 13,854,405,564 pieces, or 99.98 per cent, were distributed and redistributed correctly.

DISTANCE OF MAIL TRAVEL

The Postal Service sends its mail carriers of all classes over 12,725 routes, which aggregate 285,853 miles in length. All carriers travel annually 537,714,199 miles, equal to traveling around the earth 21,508 times. Should one man make this journey at the express train rate of fifty miles an hour, it would take him 1,230 years to cover the distance, supposing he never stopped to rest!

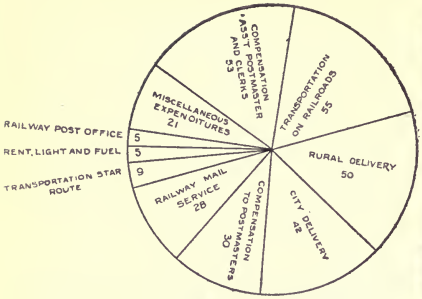
ROLLER SKATES IN THE CHICAGO POST OFFICE SAVE TIME AND SHOE LEATHER

HOW THE POST OFFICE SPENDS ITS MONEY

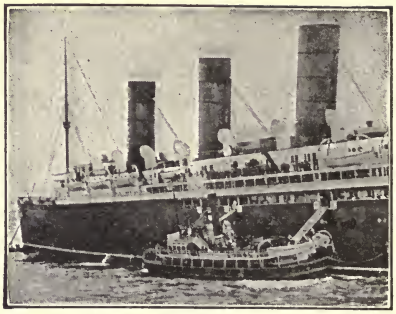
ITEMS	On account of the fiscal year 1915	On account of the previous fiscal year	Total
Compensation to assistant postmasters and clerks	$53,246,246.92	$70,301.91	$53,316,548.83
Transportation of mails on railroads	50,192,241.09	4,544,732.87	54,736,973.96
Rural delivery	49,740,895.05	48,167.82	49,789,062.87
City delivery	42,458,002.83	35,406.90	42,493,409.73
Compensation to postmasters	30,376,378.90	23,767.02	30,400,145.92
Railway Mail Service	28,382,258.77	25,984.33	28,408,243.10
Transportation of mails on star routes	7,822,300.08	956,227.93	8,778,528.01
Rent, light, and fuel	4,815,766.92	42,158.26	4,857,925.18
Railway post office car service	4,015,024.97	824,289.20	4,839,314.17
Transportation of mails—wagon service	2,351,817.43	328,908.48	2,680,725.91
Transportation of foreign mails	2,349,815.41	811,023.55	3,160,838.96
Mail-messenger service	1,933,042.14	190,224.59	2,123,266.73
Special delivery service	1,889,725.80	189.36	1,889,915.16
Manufacture of stamped envelopes	1,430,682.58	141,104.58	1,571,787.16
Post-office inspectors	1,198,181.66	30,978.06	1,229,159.72
Transportation of mails on steamboats	927,049.76	148,573.93	1,075,623.69
Transportation of mails—Pneumatic tube service	882,583.19	80,691.68	963,274.87
Transportation of mails—electric and cable cars	719,463.71	82,415.33	801,879.04
Manufacture of postage stamps	652,664.40	76,091.88	728,756.28
Freight on stamped paper and mail bags	428,127.95	184,631.24	612,759.19
Mail bags, etc	352,203.22	64,572.25	416,775.47
Manufacture of postal cards	334,549.04	36,425.31	370,974.35
Miscellaneous items at first and second class post offices	290,025.78	.....	290,025.78
Canceling machines	251,212.02	48,416.65	299,628.67
Twine and tying devices	249,966.81	6,872.96	256,839.77
Mail transportation in Alaska—star	228,367.88	73,212.44	301,580.32
Payment of money orders more than 1 year old	208,023.65	.....	208,023.65
Stationery	134,192.06	8,741.61	142,933.67
Supplies, money-order service	133,102.03	39,583.90	172,685.93
Supplies, city delivery service	129,868.46	44,535.73	174,404.19
Indemnities, domestic registered mail	128,039.39	20,292.68	148,332.07
Office appliances	116,273.28	30,256.42	146,529.70
Village delivery service	106,366.91	3,316.45	109,683.36
Shipment of supplies	98,647.09	29,748.96	128,396.05
Letter balances and scales	94,001.82	10,615.44	104,617.26
Mailbag repair shops—labor	93,074.91	273.00	93,347.91
Official and registry envelopes	76,017.26	11,670.62	87,687.88
Facing slips, etc	74,409.52	5,683.28	80,092.80
Miscellaneous items, 1st and 2d class post offices purchases	73,954.63	19,628.97	93,583.60
Mail-lock repair shops—labor	36,726.66	28.00	36,754.66
Stamping appliances	35,787.92	6,246.33	42,034.25
Rent of buildings, Post Office Dept	24,000.00	8,200.00	32,200.00
Supplies, Rural Delivery Service	12,843.89	3,944.41	16,788.30
Balances due foreign countries	1.570.91	98,873.58	100,444.49
Indemnities, lost insured mail	.....	69,852.48	69,852.48
Expenditures under 23 smaller items of appropriation (less than $20,000 each)	104,484.05	59,187.28	163,671.33
Total	$289,199,978.75	$9,346,047.67	$298,546,026.42

MAIL TEAMS LEAVING FOR THE TRAILS, INTERIOR OF ALASKA

CROSSING THE YUKON WITH MAIL AT TANANA MISSION



WHERE THE POSTAL EXPENSES LIE



UNLOADING MAIL FROM AN OCEAN LINER

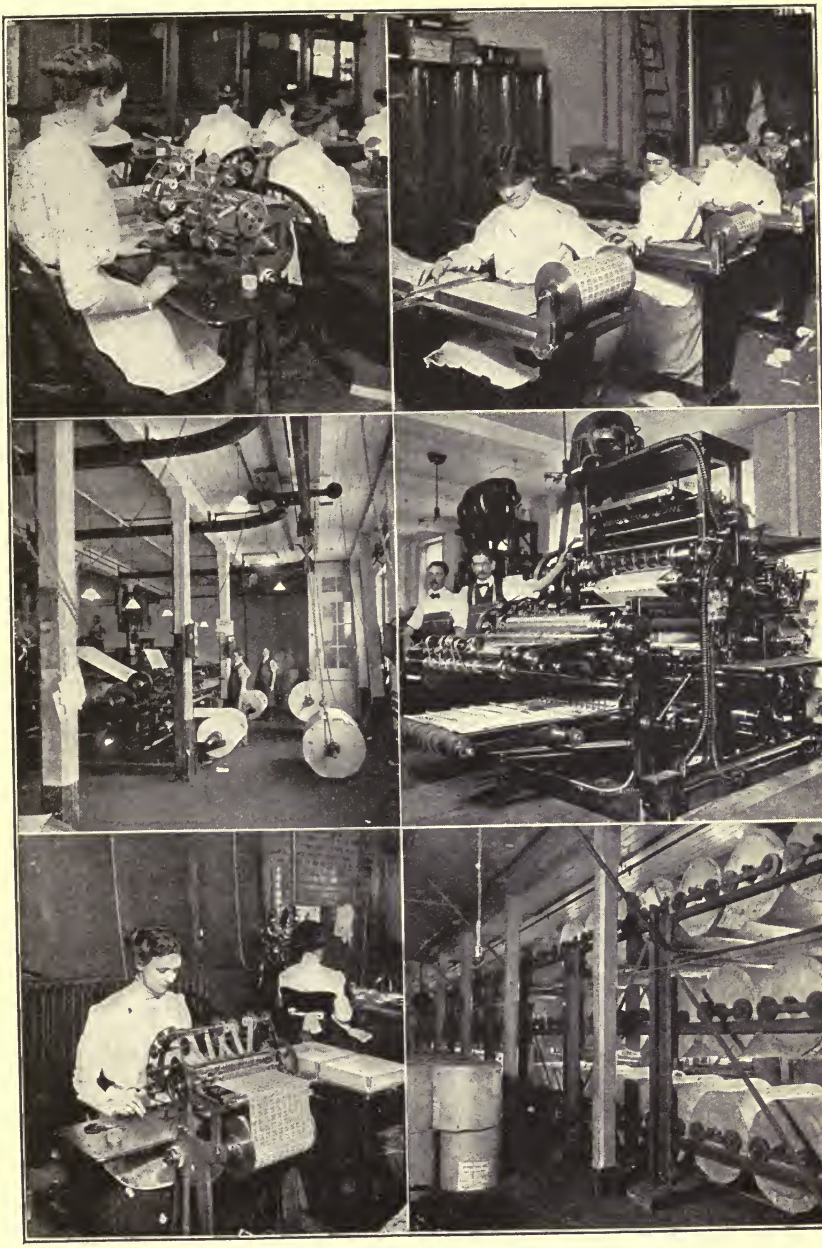
REVENUES AND EXPENDITURES

The total revenues of the Post office are $287,248,165.27, which revenues are from sale of stamps and stamped paper, postage other than stamps, foreign mails, box rents, fines and penalties, receipts from unclaimed letters, money orders and postal savings.

Its expenditures are listed in detail on page 168, because of the intense interest of some of the small items, and the light they throw on the size of the work. Consider, for a moment, the business which spends over a quarter of a million dollars a year *in twine*, which needs to buy over three hundred thousand dollars worth of *mail bags*, which requires a *shop to mend bags* which costs almost a hundred thousand dollars a year for the *labor alone* and needs over one hundred and thirty thousand dollars worth of stationery upon which to write letters about carrying letters, and some vague notion of the huge extent of this greatest of governmental activities may be had.

NOTE. — Previous years have shown a surplus, not a deficit, and 1916 will show one. The deficit of about 12 millions for 1915 is directly traceable to the falling off in receipts due to business depression caused by the war.

Additional information regarding the activities of the service may be had from the reports of the Postmaster General, reports of each of his four Assistants, report of the Solicitor's office, or the Postal Guide, a huge book of postal information sold by the Post Office to those who need its information. The officials of the Post Office should be addressed Post Office *Department*, Washington, D. C.



Coiling Stamps
Printing Postal Cards
Separating the Stamps for Coiling

Cutting Stamps
Printing Money Orders
Postal Card Stock

PRINTING STAMPS, MONEY ORDERS AND POSTAL CARDS

THE WHITE HOUSE
WASHINGTON

February 11, 1916

Sir:

It will be a signal service to our country to arouse it to a knowledge of the great possibilities that are open to it in the markets of the world. The door of opportunity swings wide before us. Through it we may, if we will, enter into rich fields of endeavor and success. In order to do this we must show an effectiveness in industrial practice which measures up to our best standards. We must avail ourselves of all that science can tell us in aid of industry and must use all that education can contribute to train the artisan in the principles and practice of his work. Our industries must be self-reliant and courageous because based upon certain knowledge of their task and because supported by the efforts of citizens in the mills. If scientific research and the educated worker go hand in hand with broad vision in finance and with that keen self-criticism which is the manufacturer's first duty to himself, the fields will be few indeed in which American commerce may not hold, if it chooses, a primary place.

Yours very truly,

Woodrow Wilson

The Editor,
The Scientific American,
New York City.

A LETTER FROM THE PRESIDENT OF THE UNITED STATES

CHAPTER XIV.

OUR NATURAL RESOURCES AND HOW THEY ARE BEING DEVELOPED

By Hon. FRANKLIN K. LANE, Secretary of the Interior

PREPAREDNESS is generally understood as the state of being ready to fight if necessary.

But the finest army and the biggest navy in the world cannot constitute real preparedness without the complete mobilization of the industrial resources, which must be behind them. Fortunately, such mobilization means profit and development for the country, in the absence of any war or threat of war.

Industry and natural resources are strained in time of war from two great causes: it is more difficult to get supplies from abroad, and the demand for what is at hand is supernormal. With an increased demand and a possible source of supply cut off, confusion follows unless a nation is industrially prepared as to its natural resources to such an extent that an abnormal demand does not throw machinery into disorder.

The natural resources of the United States are the most remarkable in the whole world. We have made some mistakes in their development, and private interests have dominated public interests in some cases. But we have seen our mistakes, corrected many of them, and are now correcting others. That this policy will continue, and that nothing will interfere with the development, conservation and proper use of our enormous natural wealth, should be the first aim of all who have real preparedness, either for war or peace, at heart.

Some months since I sought to learn what we had with which to meet the world which was teaching us that war was no longer only between armed forces, but an enduring contest between all the life forces of the contesting parties, their financial strength, their industrial organization and adaptability, their crop yields, and their mineral resources, and that it ultimately comes to a test of the very genius of the peoples involved. To mobilize even a great army is now no more than an idle evidence of a single form of strength if behind this army the nation is not organized. An army is no longer merely so many rifles and men, cartridges and horses; but chemists and inventors, mines and farms, automobiles and roads, airships and gasoline, barbed wire and turning lathes, railroads and weather prophets; indeed, the complete machinery of an industrial nation's life.

With the exception of one or two minor minerals, the United States produces every mineral needed in industry. We produce 66 per cent of the world's output of petroleum, 60 per cent of its copper, 40 per cent of its coal and iron, and 32 per cent of its lead and zinc. Tin in small quantities is produced in Alaska and platinum in Oregon, Nevada and California, manganese in Virginia,

Georgia, Arkansas and California; but of these latter minerals, as of nickel and some others of less importance, our supply is altogether inadequate for our consumption. We can build a battleship, or an automobile (excepting the tires), a railroad or a factory, entirely from the products of American mines and forests. To replenish the soil we have phosphorus in abundance, potash is known to exist in the deposits of Searles Lake, California, which, however, is not yet commercially available, and in alunite, where it is combined with aluminium and deposits of which are found in several States; and nitrogen can be extracted from the air by cheap hydroelectric power as is now done in Germany, Norway and elsewhere. So that we can feed the earth and keep it sustained. Our soil and climate are so varied that we can produce all the grains, fruits, vegetables and fibers known to the temperate zone, and some found in the semi-tropics. And to crown all these, we have water power that can be made to generate perhaps as much as 60,000,000 horse-power.

Our resources are not alone physical. Our ingenuity and ability to design the machine to meet the need have been proven a thousand times, never more convincingly than in a compilation of the most necessary inventions and discoveries which the world uses.

During the past fifty years the people of the United States have uttered two thirds of the revolutionary, epoch-making inventions of the world, from the telephone and the incandescent lamp to Wright's aeroplane and high-speed tool steel. Each day we issue an average of two hundred letters patent to American inventors, and the number of inventions is increasing with the years.

How great a resource this characteristic might be in time of need has been amply demonstrated during the present war in Europe, which has denied us imports formerly considered essential. Benzol and toluol, foundation of aniline dyes and explosives, have been produced from crude petroleum by a new process discovered by Walter F. Rittman, of the Bureau of Mines. That an increase in the amount of gasoline which is yielded by crude petroleum is also possible by the Rittman process is by no means the least of its advantages.

Barium salts, needed for a variety of purposes, were formerly imported in large quantities, although the raw material, barytes, occurs in extensive deposits in this country. We now manufacture these salts in California, Colorado, Illinois, Pennsylvania, New York, Tennessee and West Virginia, the new industry not only meeting the domestic demand, but also furnishing large quantities of barium compounds for export, and we are substituting domestic barytes for the foreign material for all purposes. The substitution of sodium cyanide for potassium cyanide in the treatment of gold ores to the extent of more than half a million pounds in Colorado alone illustrates how the potash shortage is being met throughout the mining States. Tungsten, an absolutely essential constituent in high-speed tool steel, is being mined at more points than ever before to meet the special demand in the steelworking industry; a tin smelter has been erected to reduce Bolivian ores; cobalt, which is a recent and valuable acquisition to the family of steel-alloying metals, is now being produced in quantity sufficient to lower the market price; American antimony is quoted in the metal market for the first time, and from Alaska alone more antimony has been shipped this year than was ever produced from American mines in any one year; cadmium, formerly imported, is now an article of export; and in other minor details full independence of foreign supplies is being worked out. Practically all the crude platinum from Colombia and part of the New Zea-

land output is coming to the United States for refining.

There is probably no one thing we can do more vital to real preparedness than a comprehensive conservation and development of our petroleum resources. In spite of the alarmists, statistics show no immediate prospect of a coal shortage; the total coal produced in the United States is a minute quantity compared to the supply in sight.

But of petroleum we have no such comforting statistics. How much of it there is in the United States no one knows. The Geological Survey has made a maximum estimate of twenty-three billion barrels, which sounds like an inexhaustible supply. But at the rate that it is now being consumed in this country alone (265,000,000 barrels a year) this does not mean an indefinite supply, and from the rapid exhaustion of some fields it is manifest that there can be no real approximation of the oil in our lands. Whatever the supply, it should not be allowed in its crude state to compete with coal as fuel. Petroleum is a priceless resource, for it can never be replaced. Trees can be grown again on the soil from which they have been taken. But how can petroleum be produced? It has taken the ages for nature to distill it in her subterranean laboratory. We do not even know her process. We may find a substitute for it, but have not yet. It is practically the one lubricant of the world to-day. Not a railroad wheel turns without its way being smoothed by it. We can make light and heat by hydro-electric power, but the great turbines move on bearings that are smothered in petroleum. From it we get the quick exploding gas which is to the motor and the airship what air is to the human body. To industry, agriculture, commerce and the pleasures of life, petroleum is now essential.

Among our natural resources which should be developed as speedily as possible to their full capacity as a measure of preparedness for a successful peace or the prosecution of any war into which the future may draw us, are our wonderful water powers. Among the strange things done by Benjamin Franklin was to give an added and peculiar value to the ledges of granite which confine our Western streams and turn them into dam sites, useful for purposes of power generation. How many of these are on public land not yet disposed of no one knows, but we have several hundred under withdrawal which should be freed from withdrawal and turned into use just as quickly as possible; for, as the muscle of man or horse can raise a few barrels of water from the well to supply stock or irrigate the garden patch, so can the power of the stream, turned into electricity, be used to raise millions of barrels of water to irrigate alfalfa farms or orchards. And this is now one of the most common uses of electric power in the West, and, in fact, some of the Eastern States, where irrigation is found of value. Then, too, there is that mystifying miracle of drawing nitrogen from the air for chemical use, which can be done only with great power, but is being done in Germany, Norway, Sweden, France, Switzerland, and elsewhere, by which an inexhaustible substitute for the almost exhausted nitrates of Chile has been found. This is already a great industry in Europe, and will of necessity become greater in the United States than elsewhere, because of our size and need and opportunity. To increase the yield of our farms and to give us an independent and adequate supply of nitrogen for the explosives used in war, we must set water wheels at work.

Two resources of little or no value alone, but together constituting wealth, we have in abundance. Land without water is not available for agriculture; water, master and not servant, destroys property, industry, wealth and lives.

Many rivers, great potentially as sources of irrigation, in periodical overflows and floods do incalculable damage. When we have conquered our rivers and made them serve by spreading out at our will, not theirs, over the land we wish to make blossom under the beneficent influence of irrigation, we will have added to our national preparedness a factor the value of which cannot be computed.

No one can take the yearly toll of lives lost and property destroyed by the furious and unrestrained sweep of our rivers without realizing that the people of this country cannot regard themselves as owning this land, really possessing it, until they have brought these waters under subjection. And in doing this they will literally create new land by the millions of acres, land that will support millions of people as against the thousands which live upon it to-day.

How these great works can be carried on calls for constructive thought, not merely on the engineering side, but more immediately upon the financial side as to those ways and means by which the lands reclaimed shall be made to bear in some degree the burden of the expense. As to the funds which will be needed, they mount into such figures as to be staggering. And I can see no hope that this work will be adequately undertaken without the Government advancing its credit and investing directly some of its own funds. We are conducting this Government from day to day out of current revenues. Only the richest of people could pursue such a policy. No private enterprise attempts it. No railroad system has been built that way. But few of the States now construct their highway systems out of the year's revenues. The permanent improvements which the whole people undertake are a legitimate charge against capital account, not against maintenance. A commission to devise the ways and means by which the States and private land owners and the National Government can co-operate in paying for the work done seems to me a more needed body than one which will report upon engineering methods.

There are other sides to the question upon which I have not touched: the conservation and development of our twenty-two millions of children, the men and women of to-morrow; the proper use of our forest reserves and the wise enactment and administration of laws regarding timber as well as minerals; the commercial development of the incredibly rich territory of Alaska, without its exploitation for the benefit of the few; the broad visioned development of inland waterways and rivers for commerce; the problem of good roads, which the automobile, and especially the automobile truck, is gradually working out.

But enough has been said to indicate that no country in the world has better material with which to work. I believe that conservation, in its broadest term, means not the mere saving of a resource against the possible future need, but making the conserved resource as widely useful to the greatest possible number in the shortest possible time consistent with the elimination of waste. It is along this highway that this nation must move, in my judgment, if it is to be economically, commercially, humanely prepared for any future, whether of peace or war, which is to be commensurate with the opportunities nature has given us, and worthy the American character.

CHAPTER XV.

THE MINERAL INDUSTRY OF THE UNITED STATES

Compiled from Reports of the U. S. Geological Survey

By A. H. FAY, Mining Engineer

THE magnitude of the mineral industry may be illustrated by taking into consideration the number of men employed, as follows: There are about 2,500 metal mine operators, employing 175,000 men at the mines and 50,000 men at the metallurgical plants; 6,000 coal mines, employing 734,000 men at the mines and 31,000 at coke ovens. There are 350,000 men employed in the production of pig iron and steel, 100,000 men employed at 3,000 quarries, 76,000 men employed at brick and tile works, 60,000 in the pottery and clay industry, 69,000 in glass works and 15,000 in the petroleum industry.

Barring the production in 1913, the total amount of minerals produced in the United States in 1915 was larger than in any previous year, being approximately $2,373,000,000, or a gain of 12 per cent over 1914. Of the total amount produced, the metallic products represented $987,500,000 in 1915 and $691,000,000 in 1914, an increase of 43 per cent. There was a slight decrease in the total non-metallic products in 1915, as compared with 1914, the figures being $1,423,000,000 in 1914 and $1,385,000,000 in 1915.

CONTENTS

The mineral industry of the United States

Precious metals
Gold, silver, platinum
Base metals
Iron and iron ore, copper, lead, zinc, aluminium and chromic iron ore
Miscellaneous metallic products
Antimony, bismuth, manganese, nickel, quicksilver, radium, scrap metals, tin, titanium, tungsten, uranium and vanadium
Fuels
Coal, petroleum, natural gas
Non-metallic products
Barytes, cement, clay and clay products, fluorspar, gypsum, phosphate rock, potash; salt, bromine and calcium chloride; sulphur and sulphuric acid
Miscellaneous non-metallic products
Arsenic, asbestos, asphalt, borax, feldspar, fuller's earth, garnet, gems and precious stones, graphite, lime, magnesite, mica, mineral paints, sand and gravel, slate, talc and soapstone.
Quarry industry
Mine accidents

PRECIOUS METALS

Gold

The world's production of gold in 1914 was $460,000,000, of which the United States produced $94,531,800. The United States production in 1915 was about $99,000,000. Gold is produced in twenty States, California, Colorado, Alaska, Nevada and South Dakota being the largest producers. The placer mines produce about 25 per cent and the dry or silicious ores 66 per cent. The remaining 9 per cent is from copper, lead and zinc ores. The recent high prices of copper, lead and zinc have stimulated mining, and as a result there is an increased gold production from this source.

The gold dredging industry is being

rapidly extended to large areas of low grade sands and gravels in Alaska, California, Montana, Colorado, Idaho, Oregon and Nevada. In 1904 the amount of gold produced by dredges was $2,600,000, while in 1914 it was more than $12,500,000. Improved metallurgical processes have resulted in obtaining a recovery of more than 90 per cent of the gold in the ore and made possible the profitable mining of silicious ores containing less than $3 per ton. The average amount of gold recovered per ton of ore from the deep mines of Alaska in 1914 was $2.78; from California, $5.46, and from South Dakota, $3.63. Any invention that decreases the cost of production increases the amount of ore from which gold may be recovered. It has the same effect as discovering new deposits. It is not possible to give an accurate estimate of the present supply of gold ores. There is ample, however, for many decades. One mine in Alaska produces 6,000 tons of ore per day and has more than 75,000,000 tons of ore reserves. This example is given to show the magnitude of the operations that are being planned and carried into actual practice.

The exports of gold during the calendar year 1914 were $222,616,156, while the imports were $57,387,741.

Silver

The silver production of the world for 1914 was 225,000,000 ounces, of which the United States produced one third, or 72,444,800 ounces, valued at $40,000,000. The production of silver in 1915 was about 7 per cent less than in 1914. Three fourths of the world's silver production is derived from North America, 14 per cent from Europe and the remainder from Australia and Asia. The United States contains vast quantities of low grade complex ores containing silver, copper, lead and zinc that are now unworked because of the lack of processes by which the metals can be recovered at a profit. Investigations by Federal bureaus are in progress to determine the extent of these ores and the possibility of developing processes for treating them profitably, thus making available large supplies of silver ore. There is every reason to believe that North America will continue to retain its position as the largest producer of silver.

There are twenty-five States that produce silver, of which Nevada ranks first with 15,877,200 ounces in 1914; Idaho, 12,573,800 ounces; Montana, 12,536,700 ounces; Utah, 11,722,000 ounces; Colorado, 8,804,400 ounces, and Arizona, 4,439,500 ounces. Other States produced the remainder.

The exports of silver, principally to Europe, China and India, in 1914 were 51,603,000 ounces, while the imports were 25,959,187 ounces.

Platinum

The principal production of platinum in the United States is from California and Oregon. The total amount produced in 1915 from these two States was 741.91 troy ounces, valued at $23,538. This is an increase of 171.91 ounces over the production of 1914. There was also produced by various platinum refineries 8,666 ounces of metals from the platinum group, of which 1,587 troy ounces is probably of domestic origin.

The principal source of platinum is Russia, which produced in 1914 241,200 ounces out of the world's production of 260,548 ounces. The production reported for Russia in 1915 was 124,000 ounces, while the world's production is estimated at 143,898 ounces. The imports for 1915 were about 10 per cent lower than in 1914 and amounted to 69,000 ounces, valued at $2,768,688.

The United States Geological Survey and the Federal Bureau of Mines are cooperating in a general study of placer deposits in the United States with the view of devising methods whereby platinum may be recovered from the black sands, which contain appreciable quantities of this valuable metal. Some of the gold and copper ores contain platinum in such minute quantities that it is rarely detected in ordinary assaying. The bullion obtained from these ores contains sufficient platinum to make its recovery an important by-product at gold and copper refineries. Until important sources of supply are discovered in the United States this country must depend upon Russia for its needs.

WORLD'S GOLD PRODUCTION

WORLD'S SILVER PRODUCTION

BASE METALS

Iron Ore and Iron

The production of iron ore in the United States in 1915 was 55,526,490 gross tons, or about 14,000,000 tons greater than in 1914, and valued at $1.85 per ton. With the exception of the years 1910 and 1913 this is the largest production. Of the total amount produced, the Lake Superior region, including Michigan, Wisconsin and Minnesota, produced 85 per cent, and the Birmingham district, Alabama, 8.5 per cent.

Comparatively little iron ore is imported into the United States (1,350,500 tons in 1914), the total being about 2 per cent of the quantity mined each year. The imports come mostly from Cuba, Sweden, Canada, Newfoundland, Spain and Chile. The exports of iron ore from the United States (551,618 tons in 1914) nearly offset the imports, so that the United States is self-sustaining as far as its production of iron is concerned. In the production of iron ore the United States ranks first, Germany second, France third, Great Britain fourth and Spain fifth.

The iron ore supply of the United States of commercial grade as mined at present is 7,500,000,000 tons, one third of which is in the Lake Superior district. While this amount seems enormous, yet at the present rate of production it is not difficult to foresee the time when this quantity will be exhausted. There are, however, important factors which bear upon the prolongation of the ore reserves. Among these are the development of metallurgical processes whereby lower grade ores may be utilized; improved mining methods, which will reduce waste; the discovery of new ore deposits; the importation of iron ore from Latin-America and the utilization of titaniferous iron ores.

The production of pig iron, including its various alloys, in 1915 was 29,916,213 gross tons, as compared with 23,332,244 gross tons in 1914. The average value at the furnace, in 1915, was $13.21 per ton.

In the production of pig iron the United States ranks first, followed in order by Germany, Great Britain, France and Russia. The world's production in 1913 was 78,026,869 long tons, while in 1914 it was approximately 64,000,000 tons.

The imports of pig iron (138,903 tons in 1914) and the exports (114,423 tons in 1914) almost balance each other.

Copper

The production of copper in 1915 was 1,388,009,527 pounds as compared with 1,150,137,192 pounds in 1914, or an increase of 21 per cent. The increase since 1880 has been 25-fold. Arizona, the largest producer of copper, leads with 432,467,690 pounds, followed next in order in 1915 by Montana, Michigan, Utah, Alaska, Nevada, New Mexico and California. The output in 1915 represents about 60 per cent of the world's production. Europe produces 13 per cent, Canada and Mexico 8 per cent, South America and Cuba 7 per cent, and all other countries 12 per cent.

The average price of copper for the year 1915 was 17.5 cents per pound, as compared with 13.3 cents in 1914. At the beginning of the year the price was relatively low, but started to advance until a maximum of 20 cents a pound was reached during the middle of the year.

The apparent consumption of copper in the United States in 1915 was 1,043,461,982 pounds, as compared with 620,445,373 pounds in 1914. The exports of copper bars, pigs, ingots, plates and sheets during 1915 amounted to 681,953,301 pounds, as compared with 840,080,922 pounds for 1914.

The advent of the steam shovel and the introduction of improved mining methods and metallurgical processes have so lowered the cost of production that ores yielding only 1.60 per cent copper are now worked at a profit. Such ore even ten years ago would have been considered as waste material. Leaching processes have been installed by a number of companies and the results obtained indicate that even lower grade ores may be worked. These improved processes are a tremendous factor in extending the life of the available supplies of copper ores.

Photographs from U. S. Geological Survey

Beach Mining at Topkok
Sluicing at Garfield Creek

Panning, Boulder Creek

Clima Pump, Hunter Creek
Steam Points Thawing Ground

SOME OF THE PICTURESQUE PHASES OF MINING

Lead

The production of refined lead in 1915 was 550,055 short tons, as compared with 542,122 tons in 1914. The value of the lead production in 1915 was $51,705,000, as compared with $42,286,000 in 1914. The increase in the production amounted to 1.3 per cent, while the value of the lead produced increased 22.3 per cent. Missouri leads in the production of lead with 195,634 tons, followed by Idaho with 160,680 tons. The next in order of production is Utah with 106,105 tons, followed by Colorado with 32,352 tons. The other States produced small amounts varying from a few tons to 4,000 or 5,000 tons. The imports of lead for 1915 amounted to 51,496 tons, as compared with 28,338 tons in 1914. The price of lead at the beginning of 1915 was 3.08 cents per pound, while at the close of the year it was 5.40 cents. The average New York price was 4.7 cents per pound, as compared with 3.9 cents in 1914.

Under ordinary commercial conditions, about 40 per cent of the lead is used in the manufacture of white lead, 15 per cent for pipes, 7 per cent for sheets, 10 per cent for shot and the remainder for exports and other purposes.

The normal exports of lead about equal the lead produced from foreign ores. However, the exports of domestic lead in 1914 were 58,722 short tons and 87,092 tons in 1915, while no domestic lead was exported in 1913.

Lead ores are mined in twenty-two States and the deposits are sufficiently large that the United States occupies the enviable position of having enough lead to meet all demands.

Zinc

The world's production of zinc is slightly over 1,000,000 tons per year, of which in 1915 the United States produced 489,519 short tons, as compared with 353,049 tons in 1914, representing an increase in domestic production of 39 per cent. The value of the spelter produced during 1915 was $121,401,000, as compared with $36,011,000 in 1914, representing an increase of 237 per cent. The exports of domestic spelter for 1915 amounted to 117,796 tons, as compared with 64,807 tons in 1914 and 7,783 tons in 1913. Illinois, Kansas and Oklahoma are the principal States in which zinc smelting is carried on, the amount smelted in each State in 1915 being as follows: Illinois, 159,958 tons; Kansas, 100,983 tons; Oklahoma, 109,208 tons; with 118,930 tons apportioned among the other States not enumerated. Many of the smelter plants were increased in size during the year, while a number of new smelters were constructed. The number of retorts in operation at the beginning of 1915 was 113,914, while at the end of the year they had been increased to 154,898.

The price of spelter in January, 1915, at St. Louis was 5.5 cents per pound, while in June, 1915, it had reached the phenomenal price of 26.5 cents per pound. The average price for prime Western spelter at St. Louis was 14.2 cents per pound.

Ores of zinc are widely distributed in commercial quantities in nineteen States. Missouri is the largest producer, leading with about 40 per cent. Montana is second, while large shipments originate in Colorado, Wisconsin, New Jersey and Tennessee. The supplies of ore are ample for all domestic needs.

There are large losses in the present mining and metallurgical methods; in fact, in most cases not over 50 per cent of the zinc in the ore is marketed as spelter, the remainder being lost in the various stages from mine to smelter.

A large percentage of the zinc is used for galvanizing iron and in the manufacture of brass. About 20,000 tons of zinc oxide is used each year as filler for automobile tires, while 40,000 tons find a market in the paint industry.

Aluminium

The production of bauxite, the raw material from which aluminium is made, was 297,041 long tons in 1915, valued at $1,514,834, an increase of 35 per cent in quantity and 41 per cent in value compared with 1914. Arkansas produced about 90 per cent of the domestic bauxite, while Georgia, Alabama and Tennessee contributed the remainder.

The consumption of aluminium in the United States in 1915 amounted to 99,806,000 pounds. The demand exceeded

WORLD'S PRODUCTION OF IRON

WORLD'S COAL PRODUCTION

the supply, which, together with the curtailment of imports, caused the price to be much higher than in former years. About sixty years ago aluminium was considered a chemical curiosity, valued at $90 per pound. The total amount produced in 1883 was 83 pounds. In 1889 the total production in the United States was 75 pounds per day, valued at $4.50 per pound. In 1914 aluminium was available in large quantities at 19 to 22 cents a pound, but with the increased demand due to unsettled conditions in 1915 the price rose from 19 cents in January to 57.75 cents per pound in November.

The increase in the consumption of metallic aluminium has largely been due to its lightness. The specific gravity of aluminium is 2.7, whereas brass is 3 times as great, steel 2.8 times and copper 3.3 times. Aluminium also resists the action of acids and is an important metal in the manufacture of high explosives, sulphuric and nitric acids.

Aluminium has no substitute, but it is available as a substitute for copper as a conductor of electricity. The manufacture of aluminium is an expensive process, inasmuch as it requires large electrical installations. An abundance of cheap water power is one of the prerequisites for the successful production of this valuable metal. The deposits of bauxite are far from being exhausted, while all clays contain from 10 to 40 per cent of aluminium oxide, which may be recovered by methods yet to be discovered.

Chromic Iron Ore

The production of chromic iron ore in the United States in 1915 amounted to 3,281 long tons, valued at $36,744, as compared with 591 long tons, valued at $8,715, in 1914. The domestic demand for chromic iron ore increased largely as a result of conditions abroad, whereby it was impossible to import this class of ore. California is the largest producer, while a small amount has been mined near Grant's Pass, Ore.

The average production of chromic iron ore from 1901 to 1913, inclusive, was only 250 tons, while the imports during the same period averaged 39,000 tons per year, mainly from Rhodesia and Turkey. The principal foreign deposits are in Rhodesia, New Caledonia, Russia and Turkey.

Chromium finds its principal use in the manufacture of high grade tool steel. Tool steel containing small amounts of tungsten and chromium surpasses any other known alloy as an efficient agent in machine shop practice.

Miscellaneous Metallic Products

Antimony.—The production of antimony ores in the United States in 1915 was 5,000 tons, containing 2,000 tons of antimony, valued at $325,000. The price of antimony in 1915 was the highest known since the metal became a regular article of commerce. The average monthly price for 1914 was between 5.44 cents and 7.11 cents per pound. The price of antimony rose rapidly in 1915 until it reached 40 cents per pound.

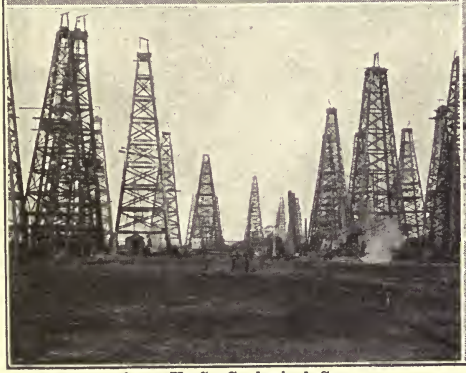
Bismuth.—Bismuth is saved as a by-product in the electrolytic refining of lead. The production in 1914 was 220,000 pounds, valued at $426,000. The imports for 1914 were valued at $165,208. The price of bismuth in 1915 varied from $2.75 to $4 per pound.

Manganese.—Only a small amount of manganese ore was mined in 1914 in the United States, 2,635 long tons, valued at $27,377. The average price at the mine was $10.37 per ton. The imports of manganese ore amounted to 283,294 tons, valued at $2,024,120. In addition to the manganese ore there was mined iron ore containing manganese to the amount of 98,265 long tons, valued at $218,497.

Nickel.—The amount of metallic nickel and nickel salts recovered from smelting plants in the United States in 1914 was 845,334 pounds, valued at $313,000. Practically all of this was saved as a by-product in the electric refining of copper. The imports of nickel amounted to $5,028,818 in 1914. Strictly speaking, nickeliferous ores are not mined in the United States.

Quicksilver.—The production of quicksilver in 1915 was 20,681 flasks, as compared with 16,548 flasks in 1914. The larger part of this production is from California and Texas. The normal price of quicksilver in 1914 was $38 per flask. The average price for 1915 was $87 per flask.

Radium.—The production of radium in 1915 was 6 grammes, as compared with 22.3 grammes in 1914. The United States has the largest known radium deposits in the world, but the principal market for radium is in Europe and on account of the war the demand ceased and hence the production was curtailed. Radium occurs in minute quantities in pitchblende and carnotite. Radium as metal has been isolated but few times. It is ordinarily recovered as a hydrous sulphate, chloride or bromide. Its prin-



Photographs from U. S. Geological Survey

Some California Wells
Some Beaumont, Texas, Wells

Hafney's Gas Well in Winter
Oil Derricks, Beaumont, Texas

OIL WELLS OF THE WEST

cipal use is in medicine as a remedy for cancer.

Scrap Metals.—The amount of secondary metals recovered from scrap, sweepings, etc., in 1915, was $114,304,930.

Tin.—Only a small amount of tin ore (155 short tons in 1914) is produced in the United States. The majority of this production is from Alaska and contains about 60 per cent metallic tin.

Titanium.—The production of titanium ore (rutile and ilmenite) in the United States for 1915 was 250 tons, valued at $25,000 and $30,000. Rutile and ilmenite are used in the manufacture of ferrotitanium, employed in making steel and cast iron.

Tungsten.—The production of tungsten in the United States in 1915 was the largest on record, being about 2,165 short tons, containing 60 per cent of tungsten trioxide, valued at slightly more than $2,000,000. The production during the first six months of 1916 was in excess of 3,000 tons. The price of tungsten ore the latter part of 1914 was $9 per unit. In the fall of 1915 the price had advanced to $48 per unit. The price of metallic tungsten rose from $1 a pound early in the year to $8 a pound in December. The principal sources of production are California, Colorado and Arizona. Its principal use is in the manufacture of tungsten high speed tool steels.

Uranium and Vanadium.—The carnotite ores produced 23.4 tons of uranium oxide and 635 tons of vanadium oxide in 1915, as compared with 87.2 tons of uranium in 1914 and 435 tons of vanadium in 1914.

FUELS

Coal

The production of coal in the United States in 1915 amounted to 531,619,487 short tons, an increase of 3.5 per cent over the amount produced in 1914. Of the total production 442,624,426 short tons, valued at $502,037,688, was bituminous coal and lignite, and 88,995,061 short tons, valued at $184,653,498, was Pennsylvania anthracite. Pennsylvania ranks first as a coal producing State, followed by West Virginia, Illinois, Ohio and Kentucky.

The total number of men employed in the coal mining industry in 1915 was 734,008, employed on an average 209 days.

The United States ranks first in the world's production of coal, followed by Great Britain ranking second, with Germany third. Much of the mining in the last fifty years has been carelessly done and enormous quantities of coal have been left in the ground and in such condition that it is doubtful whether it may ever be recovered. During each year for every 500,000,000 tons produced there is wasted or left underground at least 250,000,000 tons, thus representing an average recovery of only 66 per cent. Under the best current practice with improved mining methods many of the mines are now recovering 85 to 90 per cent. Of the total amount of energy in coal not over 11 per cent is effectively utilized.

The available coal supplies of the United States are estimated as 4,231,352,000,000 short tons, and represent about 51 per cent of the known deposits of the world. Estimates have been made, varying from 100 to 4,000 years, as to when our coal supplies will become exhausted, but it is safe to say that improved mining methods and more efficient utilization of the heat units in the coal will do much toward extending the period of depletion until some other source of heat and energy will be found.

Coke.—About two thirds of our coke is made by the bee hive process, which wastes enormous quantities of gas, tar, ammonia, benzol and other products. The installation of by-product ovens has increased rapidly and is turning into profits and dividends large quantities of the by-products wasted in the bee hive process. The recovery of the coal by-products places at the disposal of chemists and manufacturers a quantity of material from which dyes and explosives may be manufactured.

The production of coke in the United States in 1915 was 41,581,150 short tons, an increase of 7,025,236 tons (20 per cent) as compared with 1914. The number of bee hive ovens in operation in 1915 was 48,766 and the number of by-product ovens was 6,346. There were a large number of by-product ovens brought into use and all ovens were operated nearer full capacity (303 days) than in the previous year (286 days). The number of men employed at coke ovens in 1915 was 31,060.

Coke Oven By-products.—The value of coke oven by-products was $29,824,579 in 1915, as compared with $17,500,000 in 1914. The increase in benzol products

WORLD'S PRODUCTION OF PETROLEUM & VEGETABLE OILS

was the most interesting feature of the year in the coke industry. The value of this product rose from less than $1,000,000 in 1914 to more than $7,760,000 in 1915. In 1914 there were fourteen benzol plants, controlled by one company. In 1915 sixteen additional coke plants were equipped with benzol apparatus. The benzol products, including toluol, in 1915 amounted to 16,600,657 gallons. The amount of toluol produced in 1915 was 623,506 gallons, valued at $2.45 per gallon. The amount of tar obtained from coke ovens in 1915 was 138,414,601 gallons, valued at $3,568,384. The total value of ammonia obtained and sold was $9,867,475.

Petroleum

The total quantity of crude petroleum placed on the world's market in 1915 amounted to 426,892,673 barrels, or 7 per cent more than in 1914, making the production in 1915 the greatest on record. Of the total amount produced, the United States leads with 281,104,104 barrels, or 65.85 per cent of the world's production. Russia follows with 16.06 per cent, with Mexico third with 7.71 per cent.

Petroleum was first produced in this country commercially in 1859. The imports of petroleum and petroleum products for consumption in the United States were practically negligible until 1911. The total value of crude petroleum products and ozokerite imported for consumption in the United States in 1914 was $12,300,000, of which 17,200,000 barrels was crude petroleum from Mexico, valued at $11,500,000, or 93 per cent of all imported petroleum products. The total exports of crude petroleum and liquid products of petroleum amounted in 1914 to 53,334,134 barrels, valued at $140,000,000.

The growth of the petroleum industry in the United States has been rapid and has resulted in the invention of new processes and devices whereby it has been possible to increase the quantity and reduce the price of many of the petroleum by-products. The Bureau of Mines has been instrumental in the development of processes whereby the production of gasoline from crude oil may be almost doubled, and the same bureau is also devising methods for the prevention of waste in drilling for petroleum and its storage in tanks.

At the present rate of consumption of 250,000,000 barrels per year, the now available supplies will be practically exhausted within a quarter of a century. However, the increasing price of petroleum, more efficient utilization and the prevention of such large waste as is now noticeable will tend to prolong the life of the fields many years beyond the above estimate. Oil shale deposits in Colorado and Utah furnish 10 to 60 gallons per ton of rock and may become an important source of petroleum as the present supplies become depleted.

Natural Gas

The production of natural gas in 1914 was about 592,000,000,000 cubic feet, valued at more than $94,000,000. In 1885 the value of natural gas utilized in the United States was $4,857,000. Of all of the fuels produced in the United States probably the greatest waste and loss is in natural gas. As a fuel it is easy to handle; is clean, and where available is replacing all other fuels. The waste in its use, however, has been excessive, while the waste in its production is even still greater. It is estimated that in one State alone more than 250,000,000 cubic feet of gas is wasted daily, while in another field at least 400,000,000 cubic feet of gas is turned into the atmosphere each day. Investigations by the U. S. Geological Survey and the Bureau of Mines are being conducted for the conservation of this valuable fuel both in its production and in its method of use.

NON-METALLIC PRODUCTS

Barytes

The production of barytes in the United States in 1915 was 108,547 short tons, valued at $381,032, as compared with 1914, when the production was 52,747 short tons, valued at $155,647. The increased production in 1915 was largely due to imports from Germany being cut off. The principal States producing barytes follow in order of production: Missouri, Georgia, Tennessee

Photographs U. S. Geological Survey

Washing Gravels for Monazite Sand, North Carolina

200 Tons of Sulphur Ready for Shipment

Plumbago Mine, Warren County, New York

Phosphate Mine, North Carolina

SOME ODD PHASES OF MINING

and Kentucky. The deposits in these States are sufficient for domestic needs. The mineral, however, is not as pure as the imported product, so that the best utilization of these deposits will result from improved methods of bleaching and purifying the raw material.

Cement

In 1880 there were produced in the United States 85,000 barrels of Portland cement, while in 1915 the production was 86,891,681 barrels, valued at $74,756,674. The average price at the factory has decreased from $3 per barrel in 1880 to 86 cents per barrel in 1915. The wonderful development of the cement industry in the United States dates from the introduction of the rotary kiln fired with powdered coal in 1895. The United States imports comparatively little hydraulic cement, amounting to less than 100,000 barrels a year. Twenty years ago the imports of cement were more than 33 per cent of the domestic product, whereas in recent years they are less than 0.1 per cent. There is little or no need to import any ordinary cement, for all parts of the country are well supplied with the raw material and are not dependent upon any foreign source. The annual exports of hydraulic cement slightly exceed 4,000,000 barrels, or nearly 5 per cent of the production.

Clay and Clay Products

Clay.—The United States possesses immense quantities of clay, which are both suitable and available for the manufacture of clay products. In 1914 the production of raw clay (not included in the pottery or brick and tile business) in the United States was valued at $3,756,568. The closing of imports of clay from Europe on account of the war has resulted in an increased demand for high grade fire clay to replace the imported material. While many of the American clays contain a small percentage of iron, a process of eliminating the excess iron has been devised and successfully used in making some of the undeveloped clays available for higher uses. The great achievements of the clay working industries in the last half century are due to the use of American-made machines; the establishment of ceramic schools; the advertising campaigns carried on by the manufacturers of clay products, and the improvement in the quality of wares.

Pottery Products.—The value of the pottery products produced in the United States in 1915 was $37,289,456, as compared with $35,398,161 in 1914, an increase of 5 per cent. With the exception of white china, all of the pottery products increased in value in 1915 as compared with the previous year.

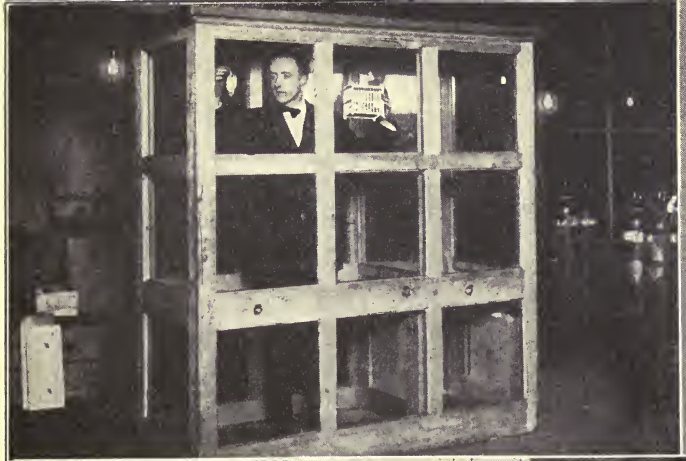
Ohio is the leading pottery State, its principal product being white ware, the output of which in 1915 was valued at $10,184,834, or nearly two thirds of the State's production, which was $15,894,597, or almost one half the total white ware production of the United States. New Jersey ranks second in the value of pottery products, West Virginia third, New York fourth, Indiana fifth and Pennsylvania sixth.

The value of the imports of pottery was $6,628,086, or $1,770,507 less than in 1914. The decrease in the imports was largely due to commercial conditions in Europe. The exports from domestic production amounted to $563,452 and re-exports from foreign imports $94,705.

Brick and Tile.—The brick and tile industry forms about 78 per cent of the clay products and in 1914 amounted to $129,588,822, as compared with $143,296,757 in 1913. Ohio, as in the pottery business, leads in this industry with $21,815,392, followed by $20,100,495 for Pennsylvania. Other important States in order of production are Illinois, New Jersey, New York, Missouri and California.

Fluorspar

The production of fluorspar in the United States in 1915 was the largest on record with a total of 136,941 short tons, valued at $764,475. In 1883 the production was only 4,000 tons. In 1915 there were imported into the United States 7,167 tons, valued at $22,878, compared with 10,205 short tons, valued at $38,943, in 1914. The principal imports are from England. The increased production of fluorspar in 1915 was taken care of by the great demand for its use in the manufacture of steel.



Chemist Demonstrating Sensitiveness of Canary Birds to Gas Poisoning
Remained Eight Minutes After Bird Died

Button of Rescue Corps

Tipple and Coal Storage Bin for Coke Ovens

Canary Birds Used to Detect Gas

THE GOOD WORK OF THE BUREAU OF MINES

The American deposits occur in Illinois, Kentucky, New Mexico, Colorado, New Hampshire and Arizona, and are ample to supply domestic requirements in case of emergency. The American product is of much higher grade than the imported material. There is need for an improvement in mining methods and processes for its preparation for market.

Gypsum

The amount of gypsum produced in the United States in 1915 was 2,447,611 short tons, valued at $6,596,893. Practically one fourth of this production is from New York, with Iowa, Michigan and Ohio following next in order. The gypsum beds in these States are large, while many of the Western States contain immense beds that have not been worked. There were 77 active quarries and 69 calcining plants in operation in 1915.

Phosphate Rock

The production of phosphate rock in the United States in 1915 amounted to 1,835,667 long tons, valued at $5,413,444. The 1915 production showed a decrease of 898,376 long tons as compared with the production in 1914. The decreased production was the result of conditions in Europe, whereby exports were not as large as in previous years. Shipments to Germany, which hitherto has been a large consumer, have practically ceased. As a result mining operations were either curtailed or suspended entirely. The principal States producing phosphate rock are Florida, Tennessee and South Carolina.

While the progress toward more efficient mining and milling methods has been great in recent years, yet the waste is much greater than it should be. The phosphate deposits are large in the South Atlantic States and in the far West, especially Idaho, Utah, Wyoming and Montana. They are in close proximity to smelting centers where there is an abundance of raw material for the manufacture of sulphuric acid, which is so essential in converting the insoluble rock to a soluble salt. Phosphate rock finds its principal use in the manufacture of fertilizer and for this reason it is of vital importance to everybody. It has no mineral substitute, hence the deposits should be conserved by their efficient utilization.

Potash

The production of potash salts in the United States in 1915 was valued at $342,000, which, while small, indicates the possibility of establishing a domestic potash industry. The imports of refined potash salts in 1915 amounted to 170,555,450 pounds, valued at $3,765,224, or slightly more than 25 per cent of those in 1913. Taking all potash salts together, the quantity imported in 1915 was about one tenth of that under normal conditions, when the total imports amount to about $15,000,000 annually. The imports of potash salts are almost exclusively from Germany. Experimental work on potash salts from different sources was active during the year and Government bureaus are using every effort to discover new sources of these valuable salts and methods for their production. The following possible sources are being investigated: (*a*)

55,000 BARREL OIL TANK STRUCK BY LIGHTNING AT TULSA, OKLA.

1. Photographing Length of Flame. 2. Ballistic Pendulum of Explosive. 3. Gas and Dust Gallery. 4. Explosion in Dust Explosion Gallery. 5. Long Combustion Chamber. 6. Calorimeter for Determining the Heating Quality of Coal

INTERESTING TESTS OF THE BUREAU OF MINES

Saline residues; (*b*) natural and artificial bitterns; (*c*) alunite and similar minerals; (*d*) potash bearing feldspars; (*e*) greensand marls, and (*f*) organic sources, as seaweed, molasses residues, etc.

Salt, Bromine and Calcium Chloride

The amount of salt marketed in 1915 was 38,231,496 barrels, valued at $11,747,686, an increase in quantity of 9.8 per cent and in value 15.2 per cent as compared with 1914. In 1915 the United States produced 99.2 per cent of the salt used, hence no need for importing this staple commodity.

Bromine is produced in connection with the manufacture of salt in Michigan, Ohio and West Virginia. The total amount produced in 1915 was 855,857 pounds, valued at $856,307. The high price of bromine in 1915 was due in part to the larger demand from abroad, where it is reported to be used in making asphyxiating gas.

Calcium chloride is one of the by-products of the natural brines of the Ohio Valley. A large amount of this salt is being wasted at present and no doubt new uses will be found which will stimulate its recovery.

Sulphur and Sulphuric Acid

Sulphur.—The principal production of sulphur in the United States is from the sulphur wells of Louisiana and Texas. The production of sulphur in 1914 was 327,634 long tons, valued at $5,954,236. The United States produces sufficient sulphur for domestic consumption and is now able to compete with Italy, which ranks second. In 1909 the exports of sulphur amounted to 37,000 long tons, while in 1914 98,153 long tons were exported, valued at $1,807,334. In 1914 26,135 tons were imported.

The mining of sulphur in Louisiana is by the Frasch process, whereby superheated water is forced into the sulphur beds. The hot water melts the sulphur, so that it is pumped to the surface in a molten condition.

Sulphuric Acid.—The most important chemical manufactured in the United States is sulphuric acid, the raw material for which is abundant in the form of native sulphur, pyrite and sulphur fumes from metallurgical plants. The production of sulphuric acid in the United States in 1915 was 3,868,152 short tons, valued at $29,869,080. Sulphuric acid is an important item in the fertilizer industry and in the manufacture of explosives. The manufacture of sulphuric acid is now becoming one of the important by-product processes in connection with the metallurgy of copper, whereby the sulphur fumes from the sulphide ores may be collected and converted into acid. This is being done on a large scale in Tennessee, and there are a number of important copper smelters in the West where thousands

Photo Underwood & Underwood

HYDRAULIC MINING

of tons of sulphur are wasted each day, all of which could be converted into sulphuric acid and become a source of profit, instead of being a detriment to growing vegetation, as is the case at present.

Miscellaneous Non-metallic Products

Arsenic.—White arsenic is recovered as a by-product from some of the copper smelters. The total production in 1914 was 4,670 short tons, valued at $313,147.

Asbestos.—The production of asbestos in the United States in 1915 amounted to 1,731 short tons, valued at $76,952. This represents an increase of 39 per cent in quantity and 306 per cent in value as compared with 1914. The asbestos deposits in the United States are not extensive and for this reason practically all of the asbestos used in the country is imported, largely from Canada. Arizona, Idaho, Georgia, Cali-

fornia and Wyoming contain promising deposits of asbestos.

Asphalt.—The production of natural asphalt from mines and quarries in the United States in 1915 amounted to 75,751 short tons, valued at $526,490. The total production was about 5 per cent less than in 1914. The quantity of manufactured asphalt produced from domestic petroleum in 1915 was 664,503 short tons, valued at $4,715,583, used principally for road building, and 388,318 short tons from Mexican petroleum, valued at $3,730,436.

Borax.—The production of borax in 1914 amounted to 62,400 short tons, valued at $1,464,400. The larger part of the borax production was from southern California.

Feldspar.—The amount of feldspar produced in the United States in 1915 was 113,769 short tons, valued at $629,316, representing a reduction of about 16 per cent in the amount produced.

Fuller's Earth.—The production of fuller's earth in 1915 in the United States was 47,901 tons, valued at $489,219. Six States reported production as follows: Arkansas, California, Florida, Georgia, Massachusetts and Texas. Florida produced about 75 per cent.

Garnet.—Practically all of the garnet in the United States is used for abrasive purposes. The production in 1914 was 4,231 tons, valued at $145,510.

Gems and Precious Stones.—The production of gems and precious stones in the United States is insignificant as compared with the imports. The total production in 1914 was $124,651, as compared with imports valued at $19,211,084 in 1914 and $45,431,998 in 1913.

Graphite.—The 1915 production was 4,718 short tons, valued at $429,631.

Lime.—The production of lime in the United States in 1915 amounted to 3,589,679 short tons, valued at $14,336,756, an increase of 6.2 per cent in quantity and 8 per cent in value over the figures for 1914. The number of plants in operation decreased from 954 in 1914 to 905 in 1915.

Magnesite.—The majority of crude magnesite comes from California. The production in 1914 was 11,293 short tons, valued at $124,223. The imports of magnesia and magnesite amounted to $1,453,508.

LABOR AND ACCIDENT STATISTICS FOR THE MINING INDUSTRY
(*Compiled from reports of the U. S. Bureau of Mines*)

	Number killed		Number injured		
	Total	Per 1,000 employed	Total	Per 1,000 employed	Number employed
Metal Mines:					
1911	695	4.19	26,577	160.12	165,979
1912	661	3.91	30,734	181.65	169,199
1913	683	3.57	32,971	172.37	191,276
1914	559	3.54	30,216	191.10	158,115
1915	553	3.64	35,295	232.02	152,118
Smelters:					
1913	47	2.29	4,247	206.53	20,564
1914	33	1.19	5,673	203.12	27,879
1915	38	1.21	5,718	182.53	31,327
Ore Dressing Plants:					
1913	16	1.07	1,977	131.93	14,985
1914	23	1.52	1,434	96.71	15,128
1915	30	1.62	2,095	112.85	18,564
Quarries:					
1911	188	1.69	5,390	48.58	110,954
1912	213	1.88	6,562	57.93	113,105
1913	183	1.72	7,739	72.83	106,278
1914	180	2.05	7,836	89.11	87,936
1915	148	1.47	9,671	96.30	100,740
Coal Mines:					
1911	2,656	3.65	*	.....	728,348
1912	2,419	3.35	*	.....	722,662
1913	2,785	3.73	*	.....	747,644
1914	2,454	3.22	*	.....	763,185
1915	2,269	3.09	*	.....	734,008
Coke Ovens:					
1913	46	1.89	2,514	103.27	24,345
1914	45	2.02	2,189	98.10	22,313
1915	38	1.22	2,852	91.82	31,060

* Not available.

Mica.—The value of the mica produced in the United States in 1915 was $428,769. The average price of sheet mica was 68 cents a pound, as compared with 50 cents in 1914 and 21 cents in 1913. North Carolina produced more than one half of the total production, followed by New Hampshire, Idaho and South Dakota.

Mineral Paints.—The production of mineral paint in 1914, including lead and zinc pigments, amounted to 173,557 short tons, valued at $10,451,746.

Sand and Gravel.—The production of glass sand in 1914 amounted to 1,619,649 short tons, valued at $1,568,030. The production of sand and gravel for moulding, building and other purposes was 77,662,086 short tons, valued at $22,278,969.

Slate.—The production of slate in 1915 in the United States was valued at $4,958,515, a decrease of 13 per cent as compared with 1914. Pennsylvania and Vermont produced more than 86 per cent of the total roofing slate, the remainder coming largely from Maryland, Virginia and New York.

Exports of slate in 1915 were $46,137, as compared with $139,125 in 1914. The exports were the lowest since 1895. The imports amounted to $2,768 in 1915, as compared with $4,855 in 1914.

Talc and Soapstone.—The amount of talc and soapstone produced in 1915 was 186,891 tons, valued at $1,891,582.

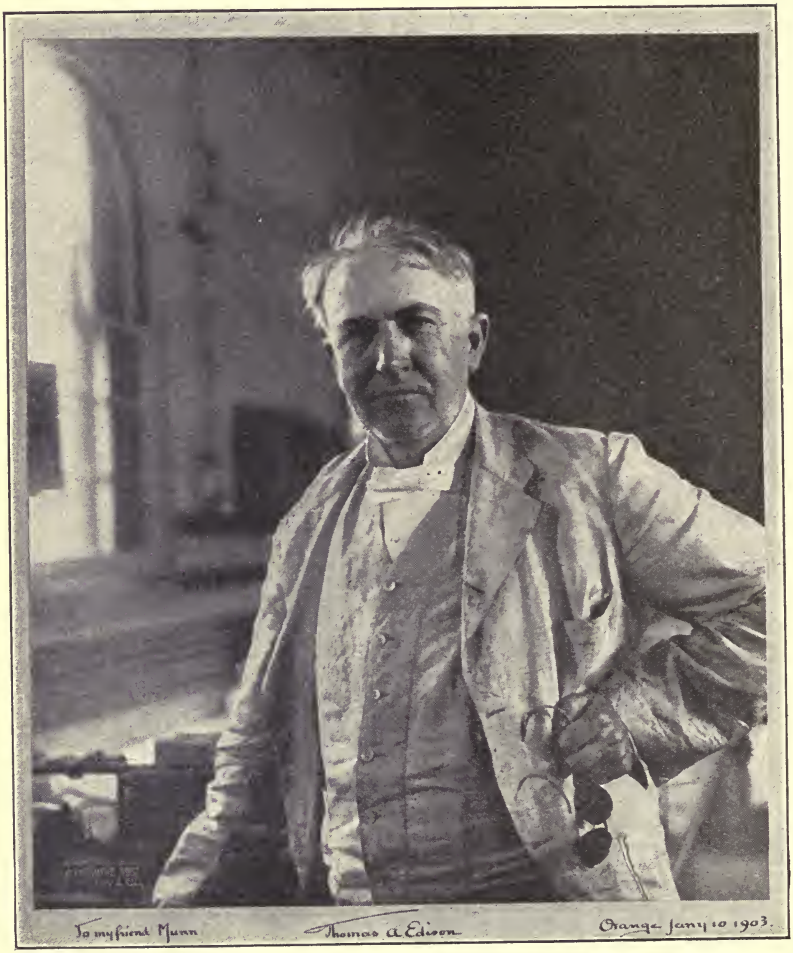
QUARRY INDUSTRY

The value of the quarry products in the United States, including granite, basalt, trap rock, limestone, sandstone and marble used for building, monumental, paving and other purposes, amounted to $77,412,292 in 1914. The granite production was valued at $20,028,019, 30 per cent of which was used in building, 23 per cent in monumental work, 14 per cent in paving and 19 per cent as crushed rock. The limestone industry is the largest, amounting to $33,894,155, of which 10 per cent is used in building and nearly 60 per cent as crushed stones, the remainder being used for paving, curbing, flagging and riprap. The marble industry is the third in size, amounting to $8,121,412, of which sixty per cent is used in building and thirty per cent for monumental purposes. Sandstone amounted to $7,501,808, while basalt and traprock amounted to $7,865,998.

ELECTRICALLY-OPERATED GANTRY CRANE SERVING BLOCK PILE

WORLD'S PRODUCTION OF COPPER, TIN & LEAD

WORLD'S PRODUCTION OF DIAMONDS AND PRECIOUS STONES



THE GREATEST INVENTOR OF THE AGE

CHAPTER XVI.

THE PATENT OFFICE AND INVENTION SINCE 1845

HOW THE GOVERNMENT HAS KEPT PACE WITH THE INVENTOR

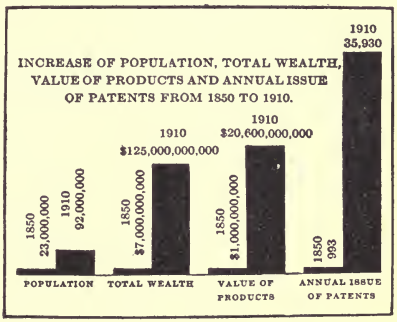
By WILLIAM I. WYMAN

IN 1845, the birth year of the SCIENTIFIC AMERICAN, the present patent system was nine years old. In 1836 the Patent Office was placed on a distinct basis, the system reorganized and the examination or American method of searching patents inaugurated.

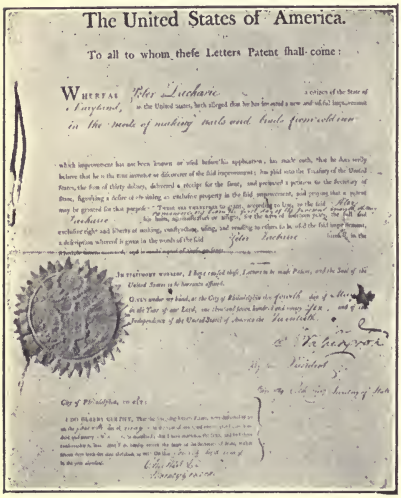
THOMAS JEFFERSON WAS THE FIRST COMMISSIONER OF PATENTS

The American patent system was founded under the act of 1790. Under this act the Secretary of State, the Secretary of War and the Attorney General constituted a board to consider all applications for patents. Thomas Jefferson, the first Secretary of State, was in effect the first Commissioner of Patents and the first Examiner. It is said that he personally examined into and determined the patentability of every application filed during his first years in office as head of the State Department. The grant of a patent then was not only a procedure of exceeding dignity, being signed by the President, the Secretary of State and the Attorney General, but was issued with some reluctance. Only three patents were permitted to see the light of day in 1790.

From this modest beginning, the business of the patent system grew slowly, but steadily. From 1790 to 1802 it required but one State Department clerk to perform all the clerical work pertaining to the Patent Office, the entire records of which were contained in a dozen pigeonholes. Up to 1836, about 10,000 patents were granted. In that year, the Patent Office became an independent bureau, headed by a commissioner, assisted by *one* examiner and six other subordinate clerks and employees. While the reorganization gave the Office a dignity and standing it did not have before, still the force provided to cope with the pressing demands of inventors does not now appear to be excessively



large. And yet critics, whose sense of economy was more acute than were their gifts of imagination, decried the sheer waste entailed by an organization so extravagant in men. But applications came pouring in, and in the following year the ex-


The United States of America.

To all to whom these Letters Patent shall come:

AN EARLY PATENT

One of the first patents signed by President Washington in possession of Munn & Co.

amining corps had to be doubled by the appointment of an additional examiner, and in 1839 the position of two assistant examiners was created to keep pace with the growing business.

The act of 1793 was the only one which provided for the grant of a patent without examination. In 1836 the modern examination system was instituted, by which a search through patents and publications was made to determine the question of novelty. This act also for the first time made a positive requirement for the inclusion of a claim in the specification in the following terms:

"He [the inventor] shall positively specify and point out the part, improvement or combination which he claims as his own invention or discovery."

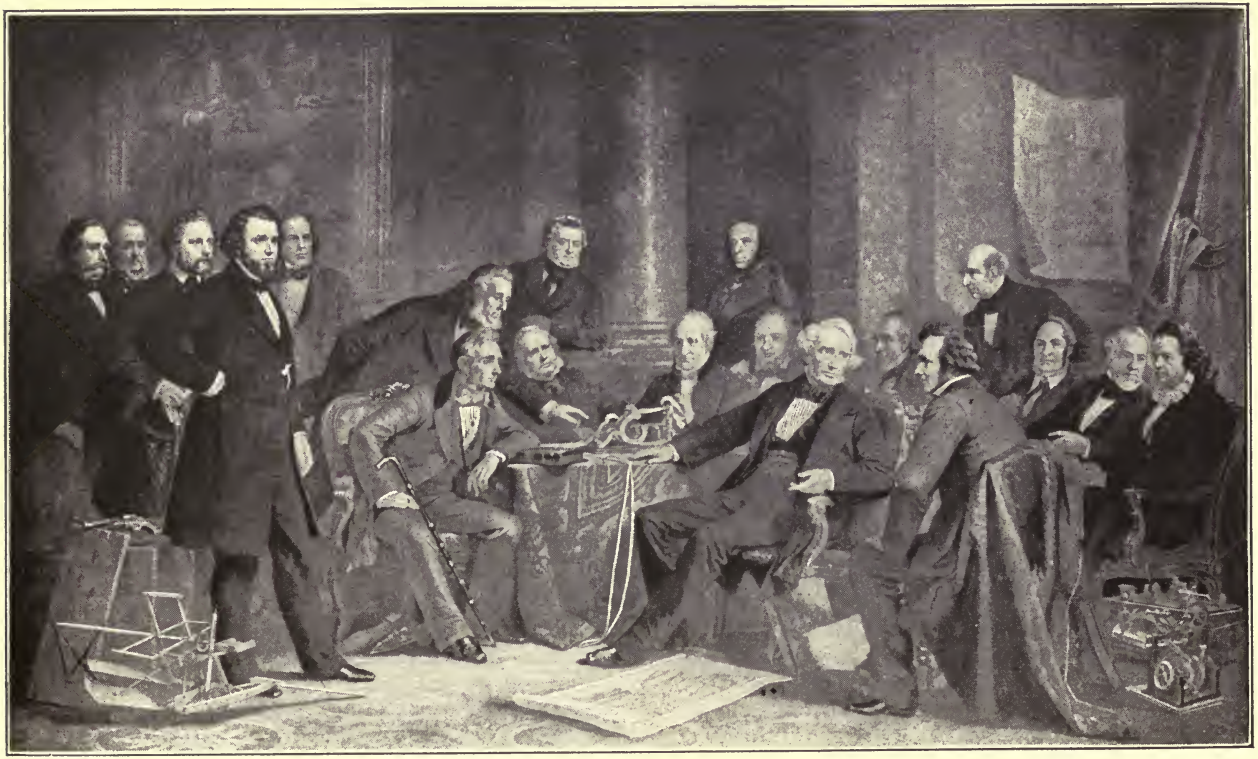
THE EARLY DAYS OF THE PRESENT PATENT OFFICE

In 1836 the erection of the Patent Office was begun; the building was finished in 1840. This original structure forms the F Street wing of the present building. In 1845 the patent system was well on its way and the Office properly housed, with an official force of one commissioner, two examiners, and two assistant examiners. In that year, 1,246 new applications were filed, besides many caveats, and the work was becoming too heavy for this limited force to handle effectively. This condition became and continues to be chronic.

Even as early as 1850, only five years after the founding of the "Scientific American" and but fourteen years after the reorganization of the Patent Office, American inventions were numbered among the most notable produced. In 1857, this country issued over one-third more patents than Great Britain, which at that time had a substantially greater population. In that year,

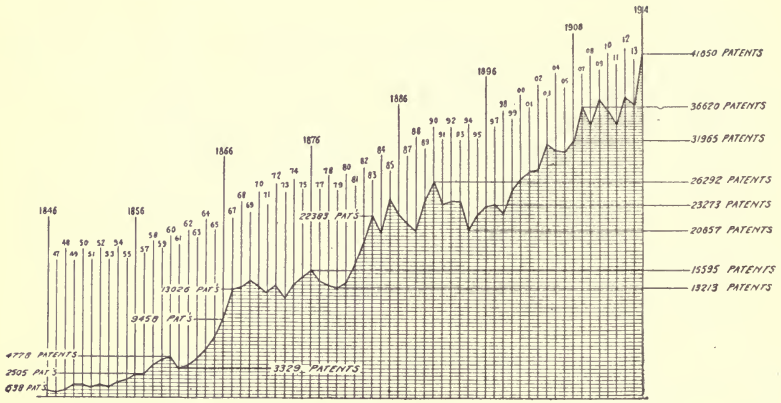
	Patents, Total Issued to that year	Total Wealth	Per Capita	Population	Value of products
1850.	7,000	7 Billion	$308	23 Million	1 Billion
1860.	27,000	16 "	514	31.4 "	1.885 "
1870.	98,000	27* "	750*	38.5 "	3.400 "
1880.	223,000	43 "	870	50 "	5.3 "
1890.	419,000	65 "	1,036	62.6 "	9.4 "
1900.	640,000	88½ "	1,165	76 "	13 "
1910.	945,000	125* "	1,400*	92 "	20.6 "

* Estimated.



MEN OF PROGRESS—AMERICAN INVENTORS

Engraved by John Sartain in 1862 from the original painting by C. Schussele and published by Munn & Co.



HOW THE NUMBER OF PATENTS HAS INCREASED YEAR BY YEAR

the United States with a population of 23,000,000 issued 2,910 patents, Prussia with almost 17,000,000 issued 48, while Russia, with 70,000,000 population, issued 24 patents. Commissioner Holt, in his annual report for that year, in reviewing the statistics, grows eloquent and philosophizes thus:

"As the light of liberty waxes dimmer, so does the inventive genius flag and dull apace, until finally, amid the darkness of the political night which broods over Eastern lands, it is utterly extinguished."

THE ANTE-BELLUM PERIOD OF AMERICAN INVENTION

During this decade, the one immediately preceding the Civil war, the stimulating influence of invention upon industry became noticeably apparent. Southern New England was tending to become a gigantic workshop and the character of entire sections of New York and Pennsylvania and Ohio radically changed from agricultural to industrial communities. The invention of the sewing machine—the greatest labor-saving device of the ages—was of itself a tremendous stimulus, and the opening up of the West through the railroad meant activity in iron production and the basic engineering industries. The reaper and the thresher made the opening up of the West profitable and the inventions in firearms, machine tools, locks and

ELIAS HOWE, JR.

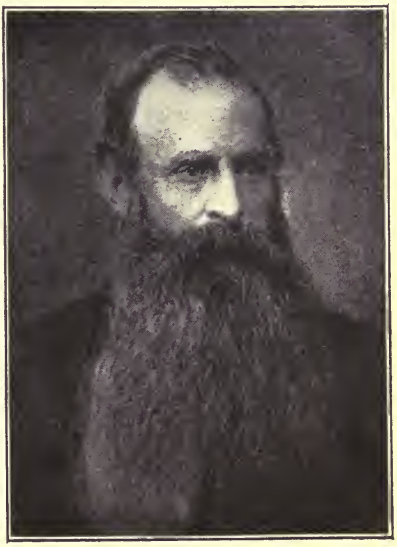
Inventor of the Sewing Machine
Born July 9, 1819
Died October 3, 1867

MONUMENT TO THE THREE HOWES AT SPENCER, MASS.

labor-saving devices and textile machinery initiated new industries and accelerated the growth of the country by leaps and bounds. By the time the Civil war broke upon the country, only a quarter of a century after the inauguration of the present patent system, and in spite of the pre-eminently agricultural character of her pursuits, this country gave every evidence that she was to be among the first of the industrial nations.

AFTER THE CIVIL WAR

The distracting period of the Civil war over, activity in enterprise increased energetically, and in the year after the Civil war closed there were filed in the office over three times as many applications as were filed in 1861. During the war, the Bessemer process was developing, and the influence of this most stimulating of inventions, which inaugurated the age of steel and our present intensive industrial era, became felt not long after its close. Then began a period of true national expansion —the further developing of the West, with strenuous enterprise in reaching out with new railroads, building of steel mills and locomotive works—marking an inflation of energy, industry and finance, which culminated in the severe panic of 1873. The country paused for a little while and took account of stock at the great Centennial Exposition in 1876. The wonders of our material advance, practically all of which were induced by invention, such as the Corliss engine, the textile machines, woodworking tools, machine tools, the sewing machine, hydraulic machinery and various kinds of automatic appliances, were there spread out for inspection to demonstrate the ingenuity of the American inventor and the intimate relation existing between him and what was making American development.



A. B. WILSON
Sewing Machine Inventor

The period from 1865 to 1880 gave inkling of the dawn of a radically new era. The electrical age was prognosticated in the dynamos of Gramme, Siemens and Brush, the Bell telephone and the arc lamp. But they left no impression upon industry or the social life of the time until the next period got into swing. From 1867 to 1879, the annual number of applications filed remained stationary and averaged around 20,000 per year, but about the time specie payments were resumed, the country appeared to take on a new lease of life. In 1867, 21,276 applications were filed, and in 1879, 20,059; in the next year (1880) the number increased to 23,012, and in 1889 reached 40,575, more than double the number filed ten years before. In that decade the country literally jumped forward and inventive ingenuity reached the golden age of its activity.

THE MOST FERTILE FIELDS OF INVENTION.

	Patents.
Carriages and Wagons..	37,728
Clasps, Buckles, Buttons	18,772
Harvesters	15,006
Plows	15,907
Mills	18,803
Machine Elements	15,062
Builders' Hardware	15,826
Games and Toys	12,164
Locks and Latches	11,930
Mills, Grinding, etc.	18,803
Railways	11,347
Railway Rolling Stock..	15,462
Seeders and Planters	11,059
Water Distribution—Mains and Pipes, Cocks and Faucets, Pipe Couplings, etc.	21,592
Wood Working	10,060
Washing Machines and Other Laundry Appliances	11,385
Steam Engines	11,907

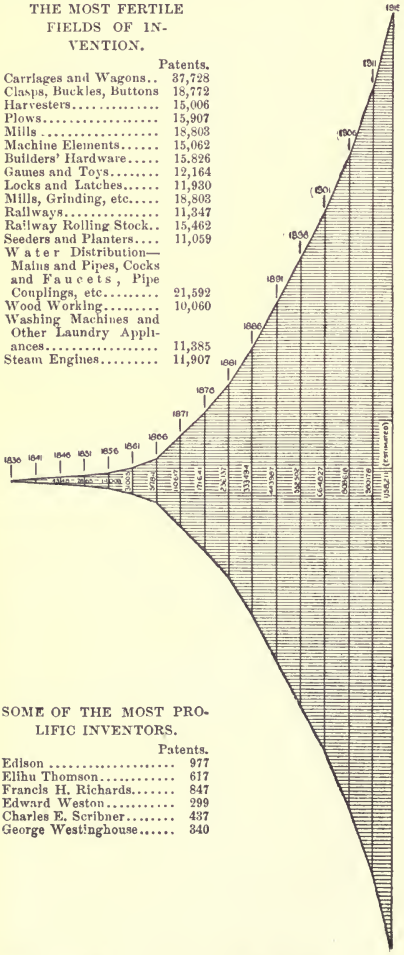


DIAGRAM SHOWING RATIO OF INCREASE OF UNITED STATES PATENTS FOR FIVE YEARS

SOME OF THE MOST PROLIFIC INVENTORS.

	Patents.
Edison	977
Elihu Thomson	617
Francis H. Richards	847
Edward Weston	299
Charles E. Scribner	437
George Westinghouse	340

THE ADVENT OF THE HIRED INVENTOR

The larger concerns have in connection with their patent departments or in association with them research laboratories with a corps of highly trained engineers and technical and scientific assistants. Every improvement of a patentable nature, if of proved utility or possible merit, becomes the subject matter of an application, not only for the monopoly that a patent may bring, but also as a protection in its manufacture and as a matter of record. The patent department advises the technicians whether a proposed device may be patented or whether it infringes an existing patent, and also appraises the validity and value of patents offered to the company for sale. The experimental department will try out new ideas or develop them to some conclusion. Many of the big things now come through these organizations, for frequently in the evolution of an art, an instrumentality may be so complex, require the expenditure of so much skill and money to develop and demonstrate, that only a company with large resources is able to handle the proposition. Thus, the General Electric Company took several years, plus an expenditure of a few million dollars, to develop the Curtis turbine. It is by no means uncommon for a promoter to spend over $100,000 to develop a process or ap-

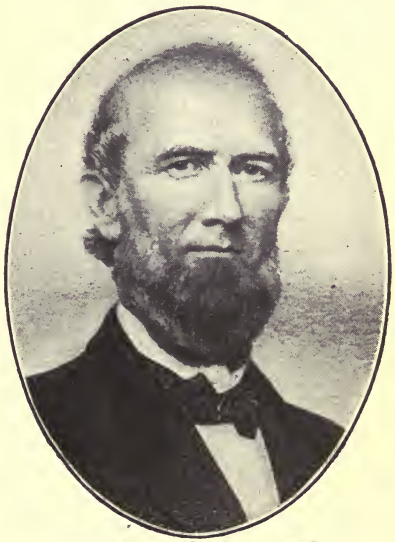
JOHN ERICSSON
Inventor of the "Monitor"

paratus so it will be marketable. Edison, who, if not incorporated, is a host in himself, frequently spent thousands upon thousands in investigations and has made experiments by the hundreds before he was in a position to announce results. There are some devices which are so intricate in design, notably type setting and casting machines, that anywhere from a quarter to one million dollars may be expended in construction and improvement, in trials and changes, only to prove eventually, what could not possibly be determined in advance, that it could not meet the various requirements demanded in commercial practice. Mark Twain sank his personal fortune of several hundred thousands in a typesetting device, probably the most intricate bit of mechanism ever devised, because, while the machine did everything it was designed to do, it was too intricate to be understood by the ordinary mechanic.

Then again, the device may be simple enough, its merits sufficiently obvious, but it may require more business acumen, push and advertising to introduce it than would be required to market an article of staple and competitive character, or sometimes no character at all. A well-known instance of this inertia on the part of the public is the case of a certain safety razor, which required prodigious efforts on the part of its promoters to eventually get the public to use what appeared to be a self-evident filling of a long-felt want. No inventor can afford to create without the protection of the patent laws, because the labor and expense he is placed under preliminary to establishing the utility of his invention becomes a fixed charge and the very means to handicap him against a piratical competitor, who can start without such a burden.

THE INFINITE POSSIBILITIES THAT LIE IN INVENTION

In 1844, Commissioner Ellsworth, contemplating the 13,500 patents

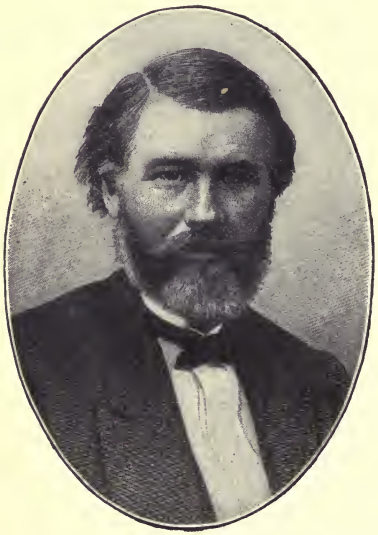


CAPTAIN JAMES B. EADS

granted up to that year, over 500 of which were issued in the year 1843, and apprehending a cessation of all endeavors in the field of invention, uttered this prediction in his official report: "The advancement of the arts, from year to year, taxes our credulity and seems to presage the arrival of that period when human improvement must end." The commissioner could well marvel at the astounding advances made in labor-saving devices during his own lifetime, but what would have been his mental state could he have been endowed with prophetic vision and have foreseen but a fraction of the inventive activity which has taken place in a man's lifetime from the date of his utterance? The number of patents now is over a million, the annual issue is more than three times the number of all the patents granted up to his day, and the examining corps has increased from four to almost four hundred without being able to keep pace with the ever growing tide of new work. It is estimated that the value of American manufactures attributable directly or indirectly to patentable inventions amounts to the enormous total of more than twenty billion dollars, which is about four times the value of *all* taxable property in the United States at the time Commissioner Ellsworth made his report.

$300,000 FOR A PATENT

THE AUTOGRAPHIC KODAK
THE DEVICE
THE PRODUCT—THE INVENTOR
THE MATERIAL REWARD



R. J. GATLING
Inventor of the Gatling Gun

It has been said that the single invention of producing steel by the Bessemer process doubled, directly or through its influence, the world's wealth in the third of a century after its introduction.

More astounding are the figures relating to the electrical industries, including telephony, central station lighting and power, and electric railways, the latest figures available showing an investment in the United States alone of seven billion dollars, annual gross revenue or sales

DAGUERRE
From an original Daguerreotype

of over a billion, in which three quarters of a million men were engaged, at an annual pay-roll of over three hundred and fifty million dollars. These industries were either non-existent in 1880 or in their incipient stage at that time. Their origins and every advance therein were directly founded on inventions, every one of which is patented and of record in the Patent Office.

THE TREND OF INVENTION

The activity of the different classes in the Patent Office from time to time reflects accurately the changes which constantly pass in the world of industry and the applied arts. The basic pursuit in this country always being the tilling of the soil, patents for agricultural implements have occupied a prominent position, both in numbers and importance throughout its history. The invention of the sewing machine initiated a period of great activity in a new art, while the telephone let loose a flood of inventions for adaptations and improvements. The new electro-chemical industry came into being about the middle of the eighties and patent activity with relation thereto was high at the same time. The incandescent lamp started the electric age, in whose vortex we still are, and patent concern in all things electrical is still intensive. The rise and fall of the bicycle, the wave of interest in automatic car couplings, the first surgings of activity in aeroplane invention, and the deep concern of the great ingenious to solve the urgent non-refillable bottle problem — all these movements have been reflected in the filing of applications in the Patent Office. In recent years the automobile is establishing records, the arts relating to internal combustion motors, carbureters, gearings, self-starters, accessories, alloy steels and heat treatment of steels being specially active.

The United States has by far the proudest record in the field of invention; whether reckoning by the number of pioneer products, their ingenuity, or their far-reaching ef-

GEORGE WESTINGHOUSE
Inventor of the Air Brake, etc.

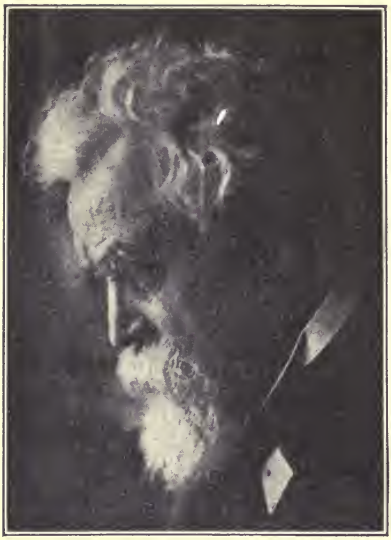


Photo by Hoppe
SIR HIRAM MAXIM

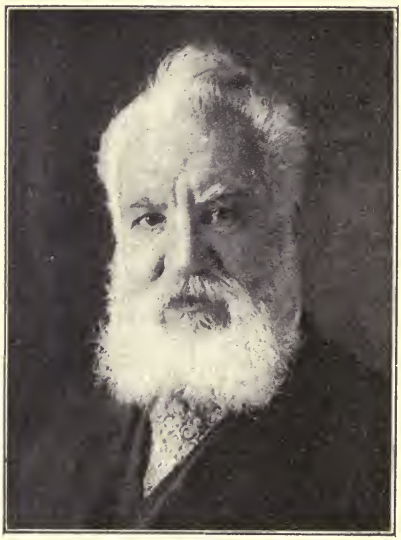
fects in the greatest diversity of fields, she easily stands in first place. Particularly in labor-saving devices does she stand foremost. No one in all history has worked so hard to save labor as the Yankee. The greatest of all labor-saving devices, the sewing machine, is his, and outside of textile machinery, practically all the great advances in this department have been of his invention, as witness the cotton gin, the reaper, shoe machinery, typewriter and typesetting machines.

In the field of electricity the American shares pre-eminence with Europeans, and yet the three most signal advances in electrical application are to his credit—the telegraph, telephone, and the incandescent lamp. Since 1880 (the typewriter was invented a few years previously) no revolutionary mechanical inventions comparable to those which signaled American ingenuity previously, was devised except the typesetting machine, but in the field of electricity (incandescent lamp, trolley car, electric welding), optics (kinetoscope, transparent film) and air navigation (an absolutely new art) he did not remain inactive.

SOME PROLIFIC INVENTORS

Between 1872 and 1900, Thomas Edison had received 742 patents; F. H. Richards, 619; Elihu Thomson, 444; Charles E. Scribner, 374; L. C. Crowell, 293; Edward Weston, 280; R. M. Hunter, 276; Charles J. Van Depoele, 245; and George Westinghouse, 239. Up to 1910 Edison secured 905 patents, of which 713 were electrical. Considering all the patents that are probably pending or in course of preparation, it is estimated that the number of his inventions is greater than 2,000. It is safe to assert that he is the most prolific inventor of all time.

Although Great Britain has more pioneer inventions to her credit involving fundamental operations that underlie all industry, than any other country, the only innovations of pioneer character she has contributed



Copyright, Harris & Ewing
ALEXANDER GRAHAM BELL

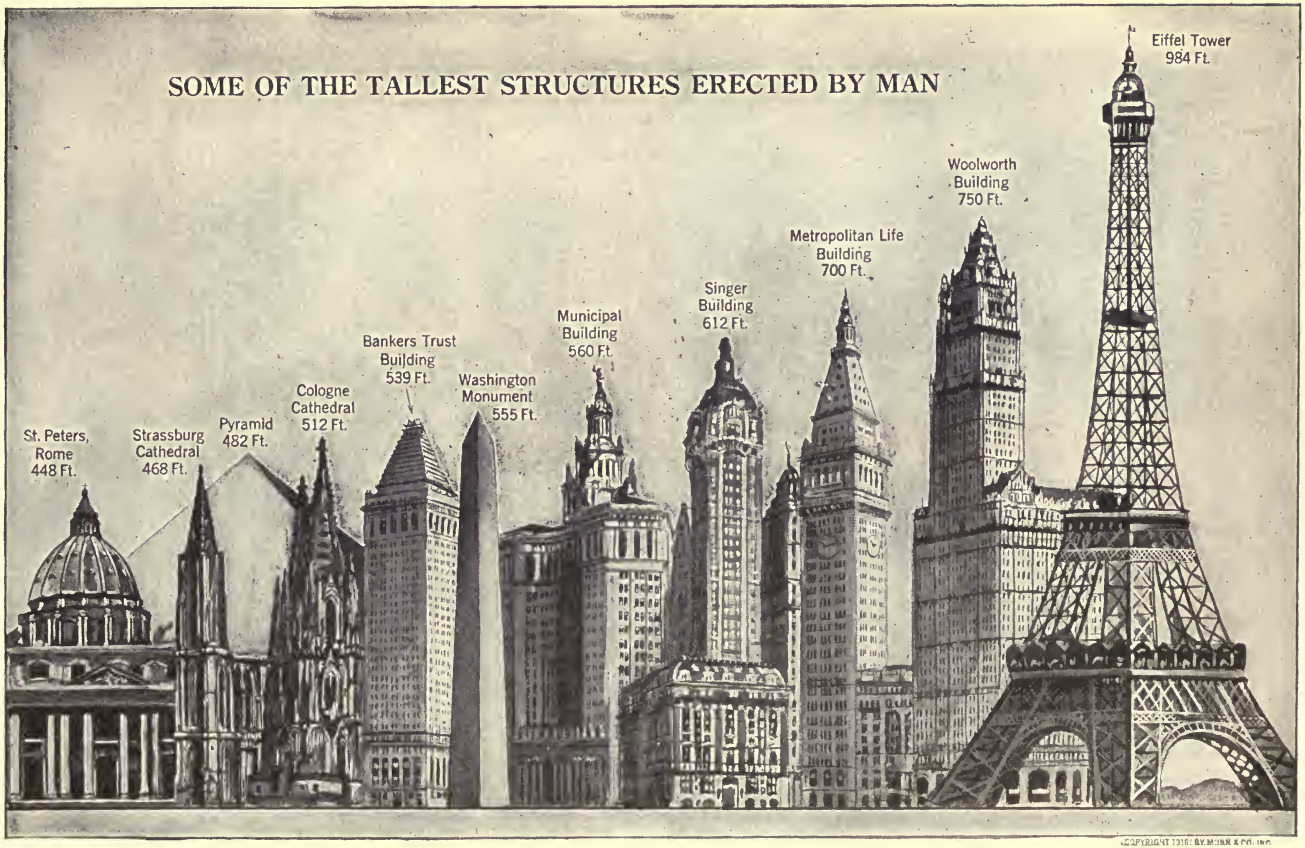
in the last one half century are the basic process for making steel, the steam turbine, and the cyanide process. But the steam engine, the greatest invention of all ages, is hers, and so is the Bessemer process,

DR. DIESEL
Inventor of the Diesel Engine

which inaugurated our present intensive industrial era.

Germany before 1871 was an almost negligible factor in the field of applied science, although she had previously to that date given ample evidence of her vigor in pure science. The adoption of a patent system based upon that of the United States was an extreme stimulus to invention, and the impetus given to inventiveness is shown by the large number of very important contributions she has devised in the last 35 years, and the increasing number of patents she has taken out in this country in recent years, now exceeding those applied for by any other foreign nation. To her sons is due the gas engine, the gasoline motor; the crude oil engine (Diesel motor); the automobile; the Welsbach lamp; the tungsten lamp; the X-ray machine; the utilization of blast furnace gases for operation of gas engines; the superheating of steam in locomotive practice; the synthesis of indigo; the contact method of making sulphuric acid; the Goldschmidt thermit process, and the innumerable and radical innovations in dye making, drugs, and chemicals.

An interesting confirmation of the changing character of our population may be made by comparing the names of inventors prominent in the earlier periods of the country's history with those which are found frequently scattered through the later additions of the Official Gazette. Fulton, Whittemore, Bigelow, Blanchard, Hoe, Campbell, Ames, Fairbanks, Howe, Colt, McCormick, etc., testify to the complete Anglo-Saxon predominance of former times, while such names as Bettendorf, Mergenthaler, Pupin, Tesla, Christensen, Doherty, Frasch, Gallagher, Conner, Monnot, Krakau, Mesta, Steinmetz, Sauveur, and Lindenthal, which are abundantly sprinkled among the names listed in recent Official Gazettes, offer proof of the leavening that is going on in all departments of American life.



CHAPTER XVII.

MANUFACTURES

THE extent of manufacturing operations in the United States is perhaps best understood by considering that during the year 1914 there were 8,265,426 persons engaged in manufacturing or 29.4 per cent of all workers engaged in gainful occupations. Of this number, 264,872 were proprietors and firm members, 964,217 were salaried employees and 7,036,337 were wage earners. With the exception of the agricultural industry, the manufacturing establishments of the United States employ more men than any other industry.

With respect to the value of the products produced, manufactures rank first, the total value of the products turned out during the year 1914 being $24,246,323,000. This amount represents the selling value or prices at the plants of the products turned out and does not necessarily have any relation to the amount of sales for the year. The cost of materials used was $14,368,089,000, leaving $9,878,234,000 as the value added by manufacture.

The salaries and wages paid out for the year amounted to $5,367,249,000, of which amount, $1,287,917,000 was paid to the 964,217 salaried employees and $4,079,332,000 to the 7,036,337 wage earners.

It is impossible in the short space allotted to this subject to more than indicate, in a general way, the extent of manufacturing operations in the United States. For convenience the industries are treated under the following headings: Manufactured Food Products, Textiles, Iron and Steel Manufactures, Transportation, the Electrical Industry, the Leather Industry, Paper and Printing and Publishing, Chemicals and Allied Products and Miscellaneous Industries. Detailed information relative to particular industries may be had by addressing the Bureau of the Census, Department of Commerce, Washington, D. C. Unless otherwise stated the statistics given are for the census of manufactures for 1914.

INDUSTRIAL PREPAREDNESS
Tabulating inventory of manufacturing plants

MANUFACTURED FOOD PRODUCTS

SLAUGHTERING AND MEAT PACKING

There were slaughtered for food in wholesale establishments during the year 1914, 7,149,042 beeves, 2,019,004 calves, 15,951,860 sheep and lambs and goats and kids and 34,441,913 hogs. The total products were valued at $1,-651,765,424. The fresh meat aggregated 6,656,031,002 pounds, valued at $769,-383,846, comprising: 3,658,333,660 pounds of beef, valued at $421,296,794; 194,698,880 pounds of veal, valued at $26,299,446; 629,232,690 pounds of mutton and lamb, including some goat meat, valued at $74,675,627; 1,877,099,071 pounds of pork, valued at $226,535,734; and 296,666,701 pounds of edible offal, dressed poultry, goat meat, and game, valued at $20,576,245. Cured meat, consisting of dry salt, pickled and smoked beef and pork, exclusive of canned meat, sausage and meat puddings, aggregated 3,020,881,494 pounds, valued at $408,000,916, and comprised 91,571,573 pounds of beef, valued at $14,395,316, and 2,929,309,741 pounds of pork, valued at $393,605,600. Canned goods, consisting of beef, pork, meat products, and other canned goods, exclusive of sausage, represented 160,-798,955 pounds, valued at $26,417,624. The output of sausage was 509,151,311 pounds, valued at $68,195,522, including 74,004,380 pounds of canned sausage, valued at $9,845,669, and also some sausage in paper cartons for which figures are not available. These figures, however, do not include the output of establishments engaged primarily in the manufacture of sausage. Of lard—comprising prime steam, pure leaf kettle-rendered, leaf, refined and neutral—1,119,188,675 pounds, valued at $120,-414,007, was rendered. The production of compound lard and lard substitutes was 396,397,950 pounds, valued at $33,-037,467; of oil—comprising oleo, lard, neat's-foot, and cooking oil—23,217,082 gallons, valued at $15,935,434; of raw and rendered tallow and oleo stock, 209,614,135 pounds, valued at $13,732,-756; of oleo and lard stearin, 30,091,-991 pounds, valued at $2,752,421; and of oleomargarine, 60,387,881 pounds, valued at $8,818,557.

CANNING AND PRESERVING

There were 538 establishments engaged in canning and preserving fish and oysters in the United States during the year 1914, the products of which were valued at $55,283,404. The total value of fish and oysters canned was $41,321,593, of which amount clams were valued at $670,363; oysters, $2,676,951; salmon, $27,633,284; sardines, $6,238,-933; shrimp, $1,725,621; tuna, $1,638,-675; and other fish, $737,766. The production of smoked or dried fish was 28,713,806 pounds, valued at $2,759,341 and was made up as follows: Finnan haddie, 4,095,693 pounds, valued at $327,877; halibut, 509,288 pounds, valued at $62,546; herring, 11,504,126 pounds, valued at $719,640; salmon, 4,248,896 pounds, valued at $638,975; sturgeon, 511,196 pounds, valued at $150,614; all other smoked or dried fish, 7,844,607 pounds, valued at $859,689. The output of salt or pickled fish was 156,153,-589 pounds, valued at $9,200,162 as follows: Cod, 83,502,295 pounds, valued at $5,561,770; haddock, 4,947,286 pounds, valued at $218,359; herring, 22,150,974 pounds, valued at $668,838; mackerel, 6,224,313 pounds, valued at $519,727; all other salted or pickled fish, 39,328,721 pounds, valued at $2,-231,468.

There were 3,199 establishments engaged in the canning and drying of fruits and vegetables, the products of which were valued at $158,015,893. The value of canned and dried fruits and vegetables packed during the year was as follows: Canned vegetables, $84,-413,667; canned fruits, $24,897,174; dried fruits, $34,771,912; canned soups, $7,877,057; other products were valued at $6,056,083.

FLOUR AND GRIST MILL PRODUCTS

The products of the 10,787 establishments, which did merchant grinding during the year 1914, were valued at $875,496,013.

The consumption of wheat by flour mills and grist mills was 543,970,038 bushels; rye, 12,748,135 bushels; corn, 180,115,704 bushels; buckwheat, 5,-478,045 bushels; barley, 20,288,396 bushels; oats, 50,227,050 bushels; other grain, 4,277,864 bushels; alfalfa, 87,884 tons; and other material, 121,965 tons.

The output for the year 1914 was as follows: Wheat flour, 116,045,090 barrels, valued at $542,051,752; rye flour and rye Graham, 1,926,795 barrels, valued at $7,801,413; buckwheat flour, 125,622,189 pounds, valued at $3,754,-857; barley meal, 14,000,789 pounds, valued at $212,343; corn meal and corn flour, 16,327,993 barrels, valued at $54,-963,301; hominy and grits, 870,364,453 pounds, valued at $13,767,561; oatmeal, 30,451,581 pounds, valued at $757,804; bran and middlings, 4,648,930 tons, valued at $104,350,655; feed and offal, 4,753,280 tons, valued at $137,067,959; corn oil, 301,949 gallons, valued at $152,208; breakfast foods, rolled oats, etc., 92,676,085 pounds, valued at $2,-932,238; all other cereal products were valued at $2,091,922 and all other products at $5,562,000.

RICE, CLEANING AND POLISHING

The total quantity of rough rice milled during the year 1914 was 1,036,587,825 pounds, or 23,035,285 bushels (of 45 pounds). Of this quantity 1,025,628,075 pounds was of domestic production, and 10,959,750 pounds of foreign.

The amount of clean rice obtained was 674,872,108 pounds, valued at $21,655,105. This was 65.1 per cent, by weight, of the rough rice milled. There were 31,053,118 pounds of polish, valued at $352,271, produced from rice during the year; 99,403,200 pounds of bran, valued at $772,275; all other products were valued at $259,643. Thus the total value of all products derived from the cleansing and polishing of rice for the year 1914 amounted to $23,039,294.

BUTTER, CHEESE AND CONDENSED MILK

During the year 1914 there were 7,982 establishments engaged in the butter, cheese and condensed milk industry, whose products were valued at $370,818,729. The quantity of milk consumed by these factories was 8,431,632,860 pounds, costing $114,314,929. The quantity of cream consumed was 2,383,828,265 pounds, costing $160,916,828.

The products, valued at $370,818,729, were divided as follows: 786,013,489 pounds of butter, valued at $223,179,254; 377,506,109 pounds of cheese, valued at $50,931,925; 884,646,761 pounds of condensed and evaporated milk, valued at $59,374,948; 21,987,911 pounds of powdered milk, valued at $2,081,607; 4,051,320 pounds of sugar, valued at $400,613; and other products valued at $34,850,382.

TEXTILES

CORDAGE AND TWINE AND JUTE AND LINEN GOODS

The total value of the cordage and twine and jute and linen goods produced during the year 1914 amounted to $83,228,424. There were produced during the year, 487,443,356 pounds of rope and binder twine, valued at $43,085,517; 13,244,198 pounds of cotton rope, valued at $2,539,906; 105,249,677 pounds of twine, other than binder, valued at $13,996,522; 75,875,322 pounds of yarn, valued at $8,320,186; 5,707,668 pounds of linen thread, valued at $3,409,136; 131,827,658 square yards of bags and bagging, valued at $6,440,594; 3,326,302 square yards of jute carpets and rugs, valued at $816,845; and other products valued at $4,619,718.

FELT GOODS

The cost of all material required in the production of felt goods during the year 1914 was $6,824,537. The total value of the products manufactured in the establishments engaged in this industry was $13,692,765. There were produced in that year, 3,941,795 pounds of endless felt belts, valued at $4,164,186; 3,028,286 pounds of boot and shoe linings, valued at $1,512,783; 7,431,152 square yards of trimming and lining felts, valued at $1,048,583; 2,291,662 pounds of saddle felts, valued at $973,353. The remaining products, including table and piano covers, felt cloth, etc., were valued at $5,993,860.

HATS, FUR-FELT AND WOOL-FELT

The output of finished fur-felt hats in 1914 was 2,118,634 dozen, valued at $33,603,531. The total value of the products of the fur-felt industry was $37,349,744.

The total value of the products of the wool-felt hat industry in 1914 was $1,944,484, of which amount, $1,777,225 represented the value of the 381,044 dozen wool-felt hats produced.

HOSIERY AND KNIT GOODS

During the year 1914 there were 1,647 establishments engaged in the manufacture of hosiery and knit goods, the products of which were valued at $263,925,855. There were 75,227,704 dozen pairs of hosiery produced, valued at $98,136,265; 21,758,775 dozen shirts and drawers, valued at $57,523,051; 6,283,360 dozen combination suits, valued at $35,630,464; 2,249,142 dozen sweaters, valued at $26,195,002; 2,470,183 dozen pairs of gloves and mittens, valued at $10,519,613; 987,178 dozen hoods, scarfs, etc., valued at $3,456,326; 274,544 dozen bathing suits, valued at $2,033,889; 63,264 dozen shawls, valued at $713,545, and 74,901 dozen pairs of leggings valued at $313,952.

In the production of hosiery and knit goods there were 3,076 sets of cards used; 852,250 spindles; 65,328 sewing machines and 142,240 knitting machines of all classes.

COTTON GOODS

The quantity of raw cotton consumed in the 1,324 establishments engaged in the manufacture of cotton goods, during the year 1914, was 2,523,500,837 pounds, costing $330,315,223. The other materials consumed were classified as follows: Cotton waste, 54,116,105 pounds, costing $3,542,631; cotton yarns, 139,482,027 pounds, costing $39,793,131; yarns, other than cotton, 3,309,277 pounds, costing $4,793,221, and fibers, other than cotton, 4,276,476 pounds, costing $3,203,262.

The total value of the cotton goods produced from these materials was $701,152,268, divided as follows: 6,815,645,683 square yards of woven goods, valued at $488,728,054; 497,986,999 pounds of yarns, valued at $127,363,952; 26,507,023 pounds of thread, valued at $22,917,099, and 13,284,875 pounds of cordage and rope, valued at $2,792,125. There were 317,360,019 pounds of cotton waste, valued at $14,421,929, on hand at the end of the year. All other products were valued at $44,037,886.

The woven goods manufactured were classified as follows: 248,539,379 square yards of ducks, valued at $47,921,989; 489,661,133 square yards of

ginghams, valued at $36,706,542; 1,422,787,368 square yards of fancy weaves, valued at $131,813,609; 263,862,227 square yards of napped fabrics, valued at $24,352,020; 29,128,703 square yards of velvets, corduroys, plushes, etc., valued at $8,540,143; 75,732,241 square yards of toweling and terry weaves, valued at $9,805,232; 97,981,783 square yards of mosquito netting and similar fabrics, valued at $2,820,524; 129,357,002 square yards of bags and bagging valued at $9,705,616; 10,137,710 square yards of tapestries, valued at $5,411,592; and 4,048,458,137 square yards of other woven goods, valued at $211,650,787.

OILCLOTH AND LINOLEUM

The total value of the oilcloth and linoleum produced by the establishments engaged in this industry in 1914 was $25,598,361. There was a decrease of 58.9 per cent in the manufacture of oilcloth during the year 1914, over the year 1909, the last census year, but this was more than compensated for by the increase of 90.1 per cent in the amount of linoleum manufactured. The oilcloth produced was divided as follows: 7,536,379 square yards of floor oilcloth, valued at $1,483,731; 18,357,097 square yards of enameled oilcloth, valued at $2,495,255; and 59,358,872 square yards of table, wall, shelf and stair oilcloth, valued at $6,025,348. The linoleum produced during the same period was divided as follows: 33,306,669 square yards of plain linoleum, valued at $10,043,436, and 8,479,202 square yards of inlaid linoleum, valued at $4,725,837. All other products were valued at $824,754.

SILK AND SILK GOODS

During the year 1914 there were 900 establishments engaged in the manufacture of silk and silk goods, in which the following materials were consumed: 22,506,759 pounds of raw silk, costing $86,586,878; 3,080,750 pounds of spun silk, costing $7,940,156; 1,902,974 pounds of artificial silk, costing $3,440,154; 4,328,536 pounds of fringe and floss, including waste, noils, etc., costing $3,066,297; 3,852,399 pounds of organzine and tram, costing $16,687,346; 16,869,511 pounds of cotton yarn, costing $6,163,240; 1,464,299 pounds of mercerized cotton yarn, costing $1,078,337; 1,987,918 pounds of woolen and worsted yarn, costing $2,087,804; 2,645,055 pounds of mohair yarn, costing $1,604,362; and 291,672 pounds of other yarns, costing $438,944.

The total value of the finished products was $253,764,170, the various products being classified as follows: 216,033,696 yards of broad silks, valued at $137,719,564; 142,713,359 yards, valued at $96,689,801, consisting of all-silk goods and 73,320,337 yards, valued at $41,029,763, consisting of mixed silk goods; 16,318,135 yards of velvets, valued at $8,570,022; 9,114,992 yards of plushes, valued at $10,135,842; 477,699 yards of upholsteries and tapestries, valued at

WORLD'S SILK PRODUCTION

$840,126; ribbons to the value of $38,201,293; laces, nets, veils, etc., to the value of $1,328,933; embroideries to the value of $33,500; fringes and gimps to the value of $1,025,188; braids and bindings to the value of $3,073,648; tailors' trimmings to the value of $210,741; military trimmings to the value of $431,422; 659,540 pounds of machine twist silk, valued at $4,036,807; 744,708 pounds of sewing and embroidery silks, valued at $5,046,452; 157,791 pounds of fringe and floss silks, valued at $598,354; 1,492,999 pounds of organzine, valued at $6,325,291; 2,577,402 pounds of tram, valued at $9,698,637, and 1,607,416 pounds of spun silk, valued at $4,577,058. Other products were valued at $13,516,248.

There were in use, during the year, a total of 2,794,971 spindles, 85,058 looms of all kinds, and 6,826 jacquard machines.

WOOLEN AND WORSTED GOODS

The total value of all the products of the 795 establishments engaged in the manufacture of woolen and worsted goods, during the year 1914, was $379,484,379 as follows: 90,950,381 square yards of all-wool woolen fabrics, valued at $55,660,503; 222,327,115 square yards of all-wool worsted fabrics, valued at $141,778,035; 47,398,289 square yards of cotton-warp woolen fabrics, valued at $13,598,007; 54,067,018 square yards of cotton-warp worsted fabrics, valued at $14,897,757; 31,400,082 square yards of cotton-mixed fabrics, valued at $11,710,610; 2,176,264 square yards of all-wool flannels for underwear, valued at $880,494; 4,995,575 square yards of cotton mixed flannels for underwear, valued at $1,089,661; 16,092,266 square yards of domett flannels and shirtings, valued at $2,814,054; 36,196,243 square yards of linings, Italian cloth and lastings, valued at $9,804,661; 8,415,079 square yards of satinets and linseys, valued at $1,535,291; 30,400,973 square yards of blankets, valued at $9,264,768; 8,164,672 square yards of horse blankets, valued at $2,017,782; 514,226 square yards of carriage cloth, valued at $443,223; 1,658,865 square yards of carriage robes, valued at $1,233,555; 121,213 square yards of woven shawls, valued at $66,365; 1,351,262 square yards of upholstery goods, valued at $1,539,381, and 3,569,709 square yards of all other woven goods, valued at $1,219,382. Woolen, worsted, merino, mohair and cotton yarns, noils and wool waste and tops and stubbing made for sale were valued at $101,137,599; all other products were valued at $5,356,615. The amount received for contract work was $5,436,636.

There were in operation during the year 4,220 sets of woolen cards, 2,348,722 mule spinning spindles, 1,531,862 frame spinning spindles, 841,449 doubling and twisting spindles, 56,392 broad looms, 19,415 narrow looms, 13 hand looms, 2,294 wool-combing machines, 1,201 pickers and 165 garnet machines.

IRON AND STEEL MANUFACTURES

BLAST FURNACES

During the year 1914 there were 284 active pig-iron blast furnaces in operation. The pig-iron products of the 160 establishments operating these furnaces aggregated 23,269,731 tons, valued at $312,639,706, and the value of other products amounted to $4,919,347, making a total of $317,559,053. The amount of iron ore used was 43,362,817 tons, costing $150,975,741. The consumption of mill cinder, scale, scrap, etc., was 2,168,092 tons, costing $6,651,055; fluxing material, 11,499,685 tons, costing $11,184,378; coke, the chief fuel for smelting, 26,883,382 tons, costing $83,499,448; charcoal, 29,083,978 bushels, costing $1,683,075; and coal, both anthracite and bituminous, 99,251 tons, costing $254,007. The smelting fuels consumed cost $85,436,530.

Of the total production of 23,269,731 tons of pig-iron, 15,495,004 tons were for the use of the producers and 7,774,747 tons for sale. The pig-iron product by grades for the year 1914 was as follows: Basic, 9,465,853 tons; Bessemer and low phosphorus, 7,883,530 tons; foundry, 4,325,100 tons; malleable, 730,910 tons; forge or mill, 488,172 tons; white, mottled and miscellaneous, 32,202 tons; direct castings, 14,384 tons and ferro-alloys, 329,580 tons.

STEEL WORKS AND ROLLING MILLS

The consumption of pig-iron and ferro-alloys by the 436 establishments producing steel and hot-rolled iron and steel manufactures as their chief products amounted to 17,060,940 tons in 1914, the cost of these materials being $248,393,208. The plants consumed approximately 10,645,000 tons of scrap, of which amount 5,065,090 tons were purchased at a cost of $59,301,614, and 5,579,422 tons were produced in the works where consumed. The consumption of iron ore amounted to 999,459 tons, costing $4,252,087. In addition, 6,440,742 tons of steel ingots, rails for rerolling and partly finished rolled products, such as blooms, billets, slabs, muck and scrap bar, sheet and tin-plate bars, etc., produced in certain mills, were purchased by others at a cost of $131,967,265.

PRODUCTS

The total products of the steel works and rolling mills for the year 1914 were valued at $919,527,244. The rolled, forged and other classified iron and steel products aggregated 25,586,715 tons,

TAKING ON A CARGO OF PIG IRON BY MEANS OF ELECTRIC LIFTING MAGNETS. NOTE HOW THE PIGS FLY TO THE MAGNET

valued at $802,976,516, comprising 18,526,342 tons of finished rolled products and forgings, valued at $624,754,421; 6,408,030 tons of partly finished rolled products—blooms, billets, slabs, sheet bars, tin-plate bars, muck bar, and scrap bar—valued at $130,674,909, and 652,343 tons of unrolled steel in the form of ingots and castings, valued at $47,547,136.

The finished rolled products and forgings produced during the year 1914 were classified as follows: Rails, 1,842,041 tons, valued at $54,009,918; rerolled or renewed rails, 63,671 tons, valued at $1,438,237; rail fastenings (splice bars, tie-plates, fish-plates, etc.), 348,947 tons, valued at $11,526,956; structural shapes (not including plates used for making girders), 2,083,440 tons, valued at $57,475,366; bars for reinforced concrete, 269,966 tons, valued at $7,751,549; merchant bars, 2,474,677 tons, valued at $84,407,700; spike and chain rods, bolt and nut rods, horseshoe bars, strips, etc., 536,575 tons, valued at $18,343,812; wire rods, 2,377,691 tons, valued at $61,578,145; plates and sheets, 3,699,249 tons, valued at $129,785,963; black plates, 1,011,938 tons, valued at $43,147,041; hoops, bands and cotton ties, 603,940 tons, valued at $19,945,078; skelp, flue and pipe, 1,960,844 tons, valued at $52,443,303; nail and tack plate, 50,302 tons, valued at $2,008,308; axles, rolled and forged, 89,418 tons, valued at $3,311,202; armor plates, gun forgings, and ordnance, 38,669 tons, valued at $19,947,893; car and locomotive wheels, rolled or forged, 137,895 tons, valued at 7,435,798; all other rolled products, 481,779 tons, valued at $29,689,872; and all other forged products, 411,402 tons, valued at $19,165,900.

AGRICULTURAL IMPLEMENTS

The total products of the 772 establishments engaged in the manufacture of agricultural implements during the year 1914 were valued at $168,120,632. The various agricultural implements manufactured comprised 3,318,176 implements of cultivation, valued at $39,632,903; 634,926 planters and seeders, valued at $12,268,156; 1,102,389 harvesting implements, valued at $40,561,472; and 140,803 seed separators, valued at $13,986,184. All other products, including parts for all classes of agricultural implements, were valued at $60,211,327. The amount received for repair work was $1,460,590.

WIRE

The total products of wire drawing establishments in 1914 were valued at $172,600,587, of which amount $166,999,888 represented the value of wire and manufactures of wire, $2,581,000 represented the value of finished products other than wire and wire products and $3,019,699 represented the value of all other products, including scrap, copperas, etc.

The total quantity of steel and iron wire drawn in 1914 was 2,465,383 tons, valued at $116,215,503, and included 459,909 tons of plain wire, valued at $22,316,778; 374,478 tons of coated wire, valued at $15,949,531; 12,886,634 tons of wire nails and spikes, valued at $23,368,633; 33,335 tons of wire brads, tacks and staples, valued at $1,324,948; 343,693 tons of barbed wire, valued at $13,764,367; 52,735 tons of wire rope and strand, valued at $7,973,537; 411,460 tons of woven-wire fence and poultry netting, valued at $19,795,812; 22,721 tons of other woven-wire products, valued at $2,822,689; and 122,720 tons of other fabricated iron and steel wire products, valued at $8,899,208.

The total quantity of copper wire drawn was 135,437 tons, valued at $42,928,550, and included 84,921 tons of bare wire, valued at $26,206,024; 48,386 tons of insulated wire, valued at $15,709,244; and 2,130 tons of woven and other fabricated copper-wire products, valued at $1,013,282.

There were also produced 39,614,500 pounds of brass wire and wire products, valued at $6,366,342; 749,224 pounds of German-silver wire, valued at $238,078; and wire of other metals and al-

loys—bronze, zinc, nickel and nickel alloys, and copper-clad steel—to the value of $1,251,415.

TIN AND TERNE PLATE

There were 31 establishments engaged in the tin and terne plate industry in 1914 whose output of coated plates amounted to 2,039,566,144 pounds, valued at $66,270,345, comprising 1,901,331,895 pounds of tin plate, valued at $60,258,024, and 138,234,249 pounds of terne plate (steel or iron plates or sheets coated with an alloy of tin and lead, known as terne mixture), valued at $6,012,321. The tin-plate product comprised 1,855,892,526 pounds of coke plate, valued at $58,450,853, and 45,439,369 pounds of charcoal plate (steel and iron), valued at $1,807,171. The value of all other products was $2,072,617, making a total of $68,342,962 for the value of all products in 1914.

CAST IRON PIPE

The cast-iron pipe product of 1914 comprised 1,092,208 net tons, valued at $25,391,714, consisting of 880,556 tons of gas and water pipe and fittings, valued at $19,218,006, and 211,652 tons of soil and plumbers' pipe and fittings, valued at $6,173,708. The gas and water-pipe output was made up of 802,967 tons of bell and spigot pipe, valued at $16,228,587; 25,192 tons of flanged pipe, valued at $645,707; 12,011 tons of culvert pipe, valued at $246,527; and 40,386 tons of fittings, valued at $2,097,185. In addition, there were produced 26,199 tons of castings other than pipe and fittings, valued at $741,381, and products other than castings, valued at $1,441,678.

TRANSPORTATION

STEAM AND ELECTRIC RAILROAD CARS

During the year 1914 there were 138,178 steam and electric cars, valued at $165,071,427, built in the United States. Of this number, 3,558 were steam-passenger cars, valued at $45,027,083 and 131,799 were freight and other cars, valued at $110,002,456. The number of electric cars manufactured was 2,821, and their value was $10,041,888. For more detailed information relative to the construction of railroad cars, locomotives, etc., the reader is referred to the special chapter on "Railroads of the United States."

CARRIAGES AND WAGONS AND MATERIALS

The total value of the carriages and wagons and materials manufactured in 1914 was $135,792,357. There were 1,187,002 vehicles of all classes, valued at $72,283,989, including 558,402 carriages, valued at $34,193,518; 572,613 wagons, valued at $36,533,152; 1,287 public conveyances, valued at $325,269; and 54,700 sleighs and sleds, valued at $1,231,959. Other products, parts, repairs, etc., were valued at $63,508,459. There was a decrease of 25.1 per cent in the production of vehicles during 1914 over 1909, due to the inroad of the automobile into the carriage and wagon industry. This has been greater with respect to pleasure vehicles than to those used for business purposes.

SHIPBUILDING

During the year 1914 there were 1,145 establishments engaged in the shipbuilding and boatbuilding industry, whose products—that is, construction and repair work done—during the year, were valued at $88,682,071. The value of work done on new vessels of five gross tons and over was $42,545,445, of which amount $36,295,758 represented the value of work done on iron and steam vessels and $6,249,687 the value of work done on wooden vessels. The value of work done on boats of less than five gross tons was $3,788,689. The value of repairs made in 1914 was $32,835,212. All other products were valued at $9,512,725.

The total number of vessels of five gross tons and over launched during 1914 was 1,113 with a gross tonnage of 424,660. There were launched 126 iron and steel vessels with a gross tonnage of 242,559; and 987 wooden vessels with a gross tonnage of 182,101. Classified according to power, there were launched 140 steam vessels, gross tonnage 234,636; 427 motor-driven boats, gross tonnage 13,220; 40 sailing vessels, gross tonnage 2,224, and 506 unrigged vessels, gross tonnage 174,580. There were 3,706 power boats of less than five gross tons launched during the year.

MOTORCYCLES, BICYCLES AND PARTS

The total value of the motorcycles, bicycles and parts manufactured during 1914 was $25,486,942. There were manufactured 62,793 motorcycles, valued at $12,306,447, an increase in number of 237.1 per cent over the year 1909, and 398,899 bicycles, valued at $5,361,229.

AUTOMOBILES

A special chapter on "Automobiles" is given as under Chapter XVIII.

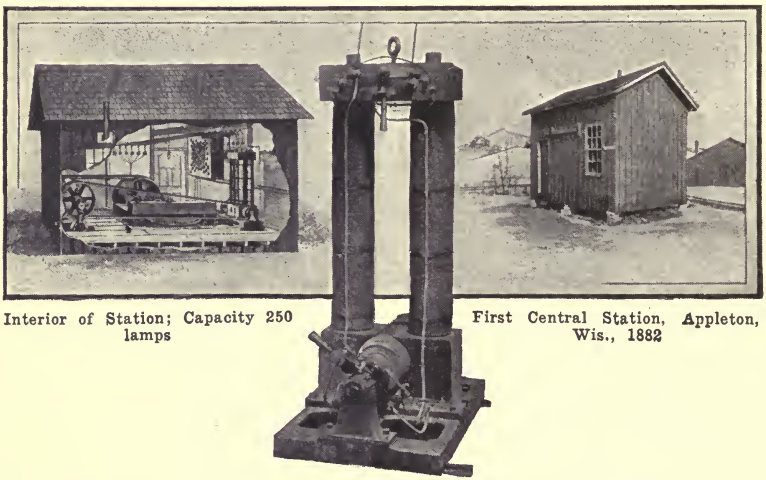
THE ELECTRICAL INDUSTRY

ELECTRICAL MACHINERY, APPARATUS AND SUPPLIES

There were 1,121 establishments engaged in the manufacture of electrical-machinery apparatus, during the year 1914, whose products, for the year, were valued at $359,412,676.

The output of dynamos, including parts and supplies, in 1914 was valued at $23,233,437. This includes dynamo-

tors, motor-generators, boosters, rotary converters, double-current generators, etc., 8,393 in number, with an aggregate capacity of 780,009 kilowatts and valued at $5,367,895; 208,548 small direct-current dynamos and automobile self-starters, valued at $5,933,273; 9,633 direct-current dynamos, including generators for direct connection to steam turbines, with an aggregate capacity of 221,221 kilowatts and valued at $2,967,467; 2,512 alternating current dynamos, including generators for direct connection to steam turbines, with an aggregate capacity of 1,188,005 kilowatts and a value of $7,437,445. The transformers manufactured in 1914 aggregated 115,843 in number, with 2,644,794 kilowatts capacity, and were valued at $13,120,065. There were 110,177 machines of less than 50-kilowatt capacity, valued at $7,316,615; 4,857 speed-controlling devices, feeder-potential regulators, reactances, voltage regulators, and rectifying apparatus to the value of $9,936,343; light and power switchboards, panel boards and cut-out cabinets, valued at $8,989,111; batteries, storage and primaries, and parts and supplies, $23,402,455; lamps, $17,350,385; arc lamps, searchlights, projectors and focusing lamps, $2,823,687; telephones, telephone switchboards, and parts and supplies, $22,815,640; telegraph apparatus, including wireless, switchboards, and parts and supplies, $2,248,375; electric heating apparatus, including air heaters, cooking devices, flat-irons, and welding apparatus, $4,034,436; electric measuring instruments, $8,786,506; electrical therapeutic apparatus, $2,653,098; insulated wires and cables, $69,505,573; electric conduits, underground and interior, $4,874,709;



Interior of Station; Capacity 250 lamps

First Central Station, Appleton, Wis., 1882

Edison dynamo of 1883

THE FIRST CENTRAL POWER STATION IN THE UNITED STATES

of from 50 to 500-kilowatt capacity, valued at $2,625,414; and 809 of 500 kilowatts and over, valued at $3,178,036.

The output of motors, including parts and supplies, was valued at $44,176,235. This includes 417,992 motors for industrial power and for railway use, with an aggregate capacity of 2,882,795 horsepower, and a value of $32,286,149; 11,880 motors for automobiles, having an aggregate horse-power of 36,858 and valued at $1,351,442; motors for fans to the value of $4,835,850 and miscellaneous motors valued at $1,190,564.

Other products were: Rheostats, resistances, controllers, motor-starting and magneto-ignition apparatus, spark plugs, coils, etc., $22,260,847; electric switches, signals and attachments, $6,393,551; carbons for furnace, lighting, brushes, battery, etc., $3,602,741; annunciators, $263,806; electric clocks and time mechanisms, $410,774; and various other kinds of electric equipment, including sockets, receptacles and bases, some electric lighting fixtures, lightning arresters, fuses, circuit fittings, and unclassified electric machinery, apparatus and supplies, $44,907,658. The last item includes electric locomotives, mine and railway, of which there were 900, valued at $3,720,914.

THE LEATHER INDUSTRY

There were tanned during the year 1914, 138,547,692 hides and skins, as follows: 17,457,591 cattle hides, costing $148,751,002. 16,067,793 calf and kip skins, costing $33,117,713; 37,755,867 goat and kid skins, costing $23,916,965; 40,090,198 sheep and lamb skins, costing $19,247,682, and 1,250,245 horsehides, 1,095,360 kangaroo skins, 233,180 colt skins and a number of hog, pig, deer, buck, seal, dog, alligator, shark, elk, moose and other skins, costing $8,414,129.

The leather products, valued at $348,956,872, were divided as follows: 18,097,665 sides of sole leather, valued at $116,347,196; 973,591 belting butts, valued at $12,876,554; 2,943,720 sides of harness leather, valued at $21,745,808; upholstery—automobile, furniture and carriage—leather to the value of $14,328,358; bookbinders' leather to the value of $1,362,673; 8,245,964 sides of cattle side upper leather, valued at $32,939,139; 965,350 sides of horse leather, valued at $2,881,924; glove leather to the value of $3,286,352; rough leather to the value of $4,511,251; 66,368,840 skins of upper leather, valued at $85,051,550; 7,698,452 skins of patent leather, valued at $15,590,812; 7,486,260 skins of fancy leather, valued at $8,775,968; 1,004,581 sides of case, bag and strap leather, valued at $5,383,255; 1,948,533 skins of chamois, valued at $925,492; and all other leather—lace, collar, saddlery, suspender, piano action leather, etc.—to the value of $21,249,116.

LEATHER GLOVES AND MITTENS

During the year 1914, there were 352 establishments engaged in the leather glove and mitten industry with products valued at $21,614,109. There were produced 3,082,376 dozen pairs of gloves, mittens and gauntlets, valued at $20,296,558, and other products to the value of $20,296,558.

The production of men's gloves, mittens and gauntlets was 2,367,263 dozen pairs, valued at $15,334,605, of which 1,571,649 dozen pairs, valued at $11,286,861, were unlined; 594,880 dozen pairs, valued at $3,584,118, were lined; and 200,734 dozen pairs, valued at $463,626, were part leather and part fabric. Of the 425,501 dozen pairs of women's and children's gloves, mittens and gauntlets, 325,530 dozen pairs, valued at $3,196,761, were unlined, and 99,971 dozen pairs, valued at $766,409, were lined. Of the 289,612 dozen pairs of boys' gloves, mittens and gauntlets, 51,797 dozen pairs, valued at $199,630 were unlined, and 237,815 dozen pairs, valued at $799,153, were lined.

FOOTWEAR

The 1,355 establishments engaged in the manufacture of footwear, during 1914, produced a total of 292,666,468 pairs of footwear, valued at $501,707,937. The total output of boots and shoes amounted to 252,516,603 pairs, of which 98,031,144 pairs were for men; 22,895,719 pairs for boys and youths; 80,916,239 pairs for women, and 48,322,395 pairs for misses and children. There were produced 2,351,106 pairs of fiber shoes of all classes. The output of slippers, not including infants' slippers and slippers made from felt or other fiber, amounted to 17,733,689 pairs. Of this number, 3,666,972 pairs were for men, boys and youths and 14,066,717 pairs were for women, misses and children. The output of infants' shoes and slippers was 15,476,763 pairs. The output of all other footwear, including athletic, sporting, logging and mining shoes, sandals, and felt and other fiber slippers, was 6,939,413 pairs.

PAPER, PRINTING AND PUBLISHING

PAPER AND WOOD PULP

The production of wood pulp in 1914 amounted to 2,894,650 tons. In addition to the domestic production there were used 534,395 tons of imported pulp. Other materials used were as follows: 371,346 tons of rags, 1,577,845 tons of waste paper, 121,230 tons of rope, jute, bagging, threads, etc., and 309,345 tons of straw.

The total value of the paper produced in 1914 was $294,355,875 and was divided as follows: 1,313,284 tons of news paper, valued at $52,942,774; 786,626 tons of plain book paper, valued at $58,496,626; 117,342 tons of coated book paper, valued at $11,605,584; 9,332 tons of plate, lithograph, map, wood cut book paper, valued at $588,332; 21,679 tons of book cover paper, valued at $2,809,377; 83,010 tons of cardboard, bristol board, card middles, tickets, etc., valued at $5,376,434; 247,728 tons of fine paper, valued at $34,054,918, including 195,351 tons of writing paper, valued at $28,637,257; 881,799 tons of wrapping paper, valued at $49,372,753; 1,288,527 tons of wood pulp, straw, news and binders' board, and all other board, valued at $41,870,947; 121,598 tons of tissue paper, valued at $11,535,720; 14,157 tons of blotting paper, valued at $1,457,897; 243,908 tons of building (roofing, asbestos and sheathing) paper, valued at $9,475,733; 96,527 tons of hanging papers, valued at $4,488,910; and 130,459 tons of miscellaneous paper, valued at $9,890,641. All other products manufactured for sale were valued at $40,558,708.

PRINTING AND PUBLISHING

During the year 1914 there were 31,612 establishments engaged in printing and publishing, of which number 12,115 were engaged chiefly in the printing and publishing of books and pamphlets, or in job printing, 180 in the printing and publishing of music and 19,317 in the printing and publishing of newspapers and periodicals.

The total value of products for 1914, of establishments printing and publishing newspapers and periodicals, was $495,905,984. The revenues of the newspaper establishments comprised newspaper subscriptions and sales, $99,541,860; newspaper advertising, $184,047,106; subscriptions and sales of periodicals other than newspapers, $64.035,230; and advertising in such periodicals, $71,906,976.

The value of products of establishments engaged chiefly in book and job work of all kinds aggregated $307,330,861. The total receipts for job printing, for the entire printing and publishing industry, were $249,730,932; for books and pamphlets, $87,316,348; for bookbinding and blank books, $15,097,109; for electrotyping, engraving, lithographing, etc., $9,698,641; for machine composition for others, $5,682,098; for ready prints (patent insides and outsides), $1,965,210; and for all other products, $13,860,525. The receipts from music printing and publishing for the entire industry were $7,626,076.

During the year 1914 there were 22,745 newspapers and periodicals published. There were 2,580 daily newspapers with an aggregate circulation of 28,436,030; 570 Sunday papers, with a circulation of 16,445,820; 84 triweekly newspapers, with a circulation of 549,495; 583 semiweekly newspapers, with a circulation of 2,483,629; 15,166 weekly newspapers, with a circulation of 50,454,738; 2,820 monthly publications, with a circulation of 79,190,838; 500 quarterly publications, with a circulation of 18,852,401; and 442 other publications, with a circulation of 8,946,567.

CHEMICAL AND ALLIED PRODUCTS

CHEMICALS

The value of the chemical products produced in 1914 was as follows: Acids, $30,001,364; alums, $3,467,969; bleaching materials, $4,964,403; cyanides, $2,398,674; plastics, $13,895,784; sodas, $22,616,696; sodium products, $8,280,572; compressed or liquefied gases, $8,097,720; chemicals produced with the aid of electricity, $29,661.649; potash and potassium salts, $4,094,927; coal-tar products, $8,839,506; fine chemicals —that is, chemicals sold in the trade as chemically pure, such as ether, chloroform, etc.—$10,316,519, and general chemical products, $47,796,271.

In addition to the allied products which are treated below in some detail, there were produced essential oils to the value of $2,565,361; refined petroleum to the value of $396,361,405 and products of wood distillation to the value of $10,236,332.

DYESTUFFS AND EXTRACTS

The total products of the dyestuff and extract industry in 1914 were valued at $21,341,122 and included dyestuffs valued at $7,118,528, tanning materials valued at $7,840,057, mordants, assistants, and sizes valued at $5,044,225, and other products to the value of $1,338,312.

EXPLOSIVES

The total production of explosives, excluding exports, in the United States during 1915 was 460,900,796 pounds, as follows: Black blasting powder, 197,722,300 pounds; "high" explosives, 235,828,587 pounds; and permissible explosives, 27,349,909 pounds.

FERTILIZERS

The output of fertilizers in 1914 aggregated 8,414,959 net tons, valued at $152,815,786, consisting of 4,488,565 tons of complete fertilizers, valued at $97,046,825; 1,116,739 tons of ammoniated fertilizers, valued at $24,344,271; 1,760,290 tons of superphosphates, acid phosphates, and concentrated phosphates, valued at $16,145,659; and 1,049,365 tons of other fertilizers, valued at $15,279,031. In addition, there were manufactured for sale other products to the value of $15,572,619, including oil, glue, grease, bone black, sulphuric acid, chemicals, etc.

PAINTS AND VARNISHES

The principal materials used by the 855 establishments engaged in the manufacture of paints and varnishes in 1914 were as follows: 149,968 tons (2,000 pounds each) of pig lead, costing $11,424,544; 887,273 gallons of grain alcohol, costing $360,737; 919,581 gallons of wood alcohol, costing $387,539; 24,025,502 gallons of linseed oil, costing $11,843,236; and 48.113,516 pounds of gum, costing 4,662,972.

The total value of the products from these materials was $149,049,820 and included colors or pigments, valued at $17,407,955; oil paints, valued at $70,582,461; water paints and kalsomine, valued at $2,202,281; varnishes and japans, valued at $36,061,203; fillers, including putty, valued at $3,239,174; bleached shellac, valued at $1,806,802; and other products valued at $17,749.944.

The production of white lead was 247,971,503 pounds, of which 71,643,812

pounds, valued at $3,697,702, was marketed dry, and 199,726,280 pounds was made into and marketed in the form of paint. The total production of lead was 61,335,290 pounds, of which 58,642,588 pounds, valued at $3,281,716, was sold as lead oxides.

TURPENTINE AND ROSIN

The total output of the 1,392 turpentine distilleries in operation in 1914 was valued at $20,968,684 and consisted of 26,980,981 gallons of spirits of turpentine, valued at $10,510,407; 2,885,077 barrels of rosin, valued at $10,332,700; and dross, valued at $125,577.

SOAP

The products of the 513 establishments engaged in the manufacture of soap during 1914 were valued at $135,340,499. The soap products were valued at $107,030,620 and other products, including glycerine, at $29,142,533. The production of hard soaps was 2,064,228,000 pounds, valued at $104,500,542 and comprised 938,447,000 pounds of tallow soap, 42,524,000 pounds of olein soap, 111,063,000 pounds of foot soap, 169,926,000 pounds of toilet soap, 367,744,000 pounds of powdered soap, 97,746,000 pounds of soap chips, and 336,778,000 pounds of other kinds of hard soap. The production of soft soap was 57,002,000 pounds, valued at $1,697,424. In addition, there were special soap articles, such as soaps for technical purposes, and liquid soap, to the value of $832,654.

MISCELLANEOUS INDUSTRIES

GLASS

During the year 1914 there were 347 establishments engaged in the manufacture of glass, the products of which were valued at $122,964,792. The value of building glass produced was $36,794,869, as follows: 400,998,893 square feet of window glass, valued at $17,466,756; 43,040,079 square feet of obscured glass, including cathedral and skylight glass, valued at $2,417,253; 60,515,008 square feet of plate glass, valued at $14,799,646; 15,688,844 square feet of wire glass, valued at $1,590,934; and all other building glass, to the value of $520,280. The pressed and blown glass produced was valued at $30,130,077; bottles, jars, etc., $51,425,022; and all other products, $4,614,824.

THE GAS INDUSTRY

The consumption of gas-making fuels by the 1,284 gas companies in 1914 comprised 6,116,672 tons of coal, costing $20,872,517; 716,619,357 gallons of oil, costing $24,934,184; 964,851 tons of coke, costing $4,706,602; and 31,749,491 pounds of calcium carbide, costing $778,037. There was also purchased by the gas companies 28,351,074,000 cubic feet of gas, at a cost of $8,883,016, a portion of which was enriched and sold, and the remainder sold as purchased.

The gas products comprise 203,730,191,000 cubic feet of gas, valued at $175,065,930, consisting of 10,509,946,000 cubic feet of straight coal gas, valued at $10,726,514; 90,017,725,000 cubic feet of carbureted water gas, valued at $74,516,534; 86,281,339,000 cubic feet of mixed coal and water gas, valued at $72,012,021; 16,601,805,000 cubic feet of oil gas, valued at $15,044,509; 137,964,000 cubic feet of acetylene, valued at $2,511,634; and 181,412,000 cubic feet of other gas, chiefly if not entirely gasoline gas, valued at $254,718. In addition, the gas plants produced for sale 114,091,753 bushels of coke, valued at $8,719,910; 125,938,607 gallons of tar, valued at $3,252,756; and ammonia liquors, ammonium sulphate, and hydrocarbons, valued at $1,405,540. They also sold "other products"—consisting largely of gas purchased for sale—to the value of $20,815,871. Receipts from rents and sales of lamps and appliances aggregated $10,977,774.

ARTIFICIAL ICE

The total cost of ammonia used in the manufacture of ice in 1914 was $1,529,775. There were 5,405,917 pounds of anhydrous ammonia used, costing $1,422,196 and 1,927,664 pounds of aqua ammonia, costing $107,579.

The total value of all products for the year was $60,352,236. There were produced 17,086,400 tons of can ice, valued at $52,116,457, and 1,179,092 tons of plate ice, valued at $3,107,839. Other products were valued at $5,127,940.

RUBBER GOODS

The products of the 331 establishments engaged in the manufacture of rubber goods during the year 1914 were valued at $300,251,827. The production of rubber tires was valued at $146,411,692 and formed 48.8 per cent of the total value of all kinds of rubber manufactured. There were manufactured 8,020,815 automobile tires or casings, valued at $105,671,223; 7,906,993 automobile inner tubes, valued at $20,098,936; solid tires for motor and other vehicles to the value of $13,735,681; and 3,728,138 motorcycle, bicycle and aeroplane tires, valued at $6,905,852.

There were manufactured during the year 4,024,486 pairs of boots, valued at $12,647,934, and 57,211,728 pairs of shoes, valued at $37,858,222. The value of rubber clothing produced was $6,396,810; of garden, fire, and other hose, $16,853,693; of rubber belting, $7,989,405; of rubber packing, $3,507,651; of druggists' and stationers' sundries, $7,-

527,755; and of miscellaneous manufactures of rubber, $39,983,969.

STEAM LAUNDRIES

In the year 1914 there were 6,097 steam laundries in the United States, with 149,100 persons engaged in the industry. The capital invested was $98,055,001. The cost of materials was $26,919,200 and of services, $71,764,059. The amount received for work done, which is regarded as the product of the industry, was $142,503,253.

GLUCOSE AND STARCH

The principal materials used in the manufacture of glucose and starch are corn, potatoes and wheat flour, the consumption of these materials in 1914 being 2,488,792,405 pounds, 169,878,784 pounds, and 14,198,049 pounds, respectively. The total value of the manufactured products was $51,676,653. The principal products were 620,764,347 pounds of starch, valued at $15,783,781; 847,180,968 pounds of glucose, including all sirups, valued at $18,541,429; 174,368,818 pounds of grape sugar, valued at $3,765,515; 8,861,579 gallons of corn oil, valued at $3,693,163; and 143,001,065 pounds of corn-oil cake and meal, valued at $1,829,305. Stock feed was valued at $6,690,412, and all other products at $1,373,048.

PIANOS AND ORGANS AND MATERIALS

The total value of the pianos, organs and materials manufactured in 1914 was $68,769,476. The number of pianos manufactured was 325,893, valued at $56,266,362. There were 227,556 upright pianos without player attachments, valued at $31,385,881; 87,808 upright pianos for (or with) player attachments, valued at $20,265,514; 9,698 grand pianos without player attachments, valued at $4,201,302; and 831 grand pianos for (or with) player attachments, valued at $413,665. There were 6,493 separate player attachments manufactured with a value of $854,774. The number of organs manufactured was 42,806, valued at $6,378,312. There were 2,273 pipe organs, valued at $4,660,301, and 40,533 reed organs, valued at $1,718,011. The value of perforated music rolls manufactured was $833,357; piano parts, materials and supplies, $2,792,942; and all other products, $1,643,729.

PHONOGRAPHS, GRAPHOPHONES AND TALKING MACHINES

The number of phonographs, graphophones and talking machines, including office-dictating instruments, manufactured during 1914, amounted to 515,154 machines, with a value of $15,290,491. The 27,221,290 records and blanks produced were valued at $11,111,418. Parts, materials and supplies were valued at $356,935 and other products at $357,072.

CHAPTER XVIII.

THE AUTOMOBILE INDUSTRY

NOTHING in modern invention, in the progress of labor-saving devices, in the application of invention to every-day life, can show a parallel with the remarkable development of the automobile.

Everyone whose memory goes back ten or fifteen years can see to some extent the effects of this development, but only figures can give an adequate idea of the wonderful growth of the industry from nothing to its present huge proportions.

In 1914 there were three hundred establishments devoted to the manufacture of automobiles exclusively, producing 573,114 cars. A total of 91,997 people were employed, of which 60 were firm members or proprietors, 12,630 salaried employees, and 79,307 wage earners. The capital employed in the industry aggregated $312,876,000, and a total of $84,901,000 was disbursed in payment for services, $66,935,000 for wages, and the balance, $17,966,000, for salaries.

Materials to the value of $292,598,000 were purchased for the manufacture of automobiles. The manufacturing process added $210,632,000 to this, giving a value of automobiles made in 1914 as $503,230,000.

These figures, of course, represent only a part of the automobile industry, and, indeed, so rapid is its progress that 1916 figures, if they were obtainable, would show a large increase over those given.

The manufacture of automobile bodies and parts is in itself an enormous industry, sprung, almost overnight, with the demand for more automobile members than the makers of the machine themselves could supply.

In addition, in 1914, 33 establishments primarily engaged in other lines of manufacture, produced automobiles to the value of $6,636,920, and 434 establishments of this character manufactured automobile bodies and parts to the value of $10,515,070.

Nine hundred and seventy-one establishments, employing a total of 53,954 people, made automobile parts and bodies in 1914. Seven hundred were firm members or proprietors, 5,469 salaried employees, and 47,785 wage earners. Capital was invested in the industry to the amount of $94,854,000, and $54,552,000 was paid out for services rendered, $19,560,000 for salaries, and $34,992,000 for wages. Materials valued at $63,610,000 were worked into products valued at $129,601,000, the process thus adding $65,991,000 to the worth of the raw material.

At the 1909 census, 315 establishments engaged in the manufacture of automobiles either as a primary or as a subsidiary product; and their output was 127,287 machines, valued at $165,099,404. During the five years, 1909-1914, there has been an increase of 350.3 per cent in the number of automobiles manufactured, and of 181.7 per cent in their total value.

Of the automobiles manufactured during 1914, those operated by gasoline or steam power numbered 568,-

399, and those operated by electricity, 4,715, as compared with 123,452 operated by gasoline or steam, and 3,835 by electric power, manufactured in 1909. The increase during the five years in the number of gasoline and steam machines manufactured is thus 360.4 per cent, and in the number of electrics, 22.9%.

Touring cars formed the principal type manufactured during both census years. In 1914 the output of this class of machines was 454,876, valued at $351,585,518, compared with 76,189, valued at $113,510,575 in 1909. Of the total products for 1914, the number designed for pleasure or family use was 544,255, compared with 119,190 in 1909. For business purposes and for use as public cabs, omnibuses, ambulances, patrol wagons, fire-fighting machines, and for other business purposes, 24,144 machines were manufactured in 1914, compared with 4,262 in 1909. The output of delivery wagons and trucks was 22,753 in 1914, compared with 2,771 in 1909.

HORSE-POWER

The production of vehicles of less than 10 horse-power amounted to only 391 in 1914; of from 10 to 19 horse-power, to 45,116; of from 20 to 29 horse-power, to 346,399; of from 30 to 49 horse-power, to 163,468; and of 50 horse-power or more, to 13,025. It is interesting to note that 104,983 horse-power is developed in the automobile manufacturing plants and 68,701 in the plants making bodies and parts.

A GLORIOUS VIEW FROM THE PIKE'S PEAK AUTO HIGHWAY

THE OLD AND THE NEW TRANSPORTATION

COMPARISON 1909-14

The following table, listing the totals of automobile manufacturers and makers of bodies and parts, shows in a graphic way the growth of the industry.

It is not, however, only in the statistics of the industry that its effects are to be shown. An automobile is not like a pair of shoes, bought, used up and discarded in a year to make room for a new pair. The automobile is bought and kept for several seasons, so that only a part of the new output is absorbed by the experienced owner. The result is that the automobile wealth—or money invested in machines which yet have a tangible and tremendous value—is almost beyond computation.

TABLE SHOWING GROWTH OF THE AUTOMOBILE INDUSTRY

	1909	1914	Percent of increase 1909–1914
Number of establishments	743	1,271	71.0
Machines manufactured	127,287	573,114	350.3
Persons engaged in manufacture:	85,359	145,951	71.0
Proprietors and firm members	405	760	87.7
Salaried employees	9,233	18,099	96.0
Wage earners	75,721	127,092	67.8
Primary horsepower	75,550	173,684	129.9
Capital	$173,837,000	$407,730,000	134.5
Services	58,173,000	139,453,000	139.7
Salaries	9,479,000	37,526,000	295.9
Wages	48,694,000	101,927,000	109.3
Materials	131,646,000	356,208,000	170.6
Value of products	249,202,000	632,831,000	153.9
Value added by manufacture (value of products less cost of materials)	117,556,000	276,623,000	135.3

NUMBER OF CARS

Only the registration of automobiles (in the absence of a census) can give any adequate idea of how many machines are actually in use.

During the past ten years the State registration of motor cars, including commercial vehicles, has increased 5,000 per cent, or from about 48,000 in 1906, to 2,445,664 in 1915.

The first revenue derived by the State governments from automobile registration was collected in the State of New York in 1901 and amounted to only $954. Other States gradually took up the registration of motor vehicles, chauffeurs, and operators, but for several years revenue from these sources was negligible. The total amount collected by the various States in 1905 amounted to only $62,500. The increase in subsequent years has been almost phenomenal, and during 1915 the total gross revenues derived from the registration of motor vehicles and the licensing of operators, chauffeurs, dealers, etc., amounted to $18,245,713.

Motor vehicles registered under the general designation of automobiles, motor trucks, and commercial vehicles in continental United States during 1915 amounted to 2,445,664. The road mileage of the United States outside of incorporated towns and cities is approximately 2,375,000 miles. There is, therefore, an average of slightly more than one car for each mile of rural public road. The distribution among the several States, however, is far from uniform. There is only one motor for every six miles of road in Nevada, while in New Jersey there are nearly six motor cars per mile of road. With an average of one motor car for every 44 persons in the United

Good Roads and Auto Buses Add Greatly to Our Pleasures
The Modern Land Houseboat Is Like a Gipsy Caravan
A Modern "Jitney" Bus

SOME COLLECTIVE MEANS OF TRANSPORTATION

States, in Iowa there is one for every 16 persons, but only one for every 200 persons in Alabama.

AUTOMOBILE ACCIDENTS

That more just laws, an appreciation of the other fellow's rights and a standard of good driving, set by familiarity and public opinion, are having their effect upon "Safety First" is unquestionable.

From 1909 to 1914 the number of automobiles increased more than twice as rapidly as the number of fatalities caused by them. According to figures of the National Automobile Chamber of Commerce, the number of automobiles in use in the United States was in 1904 approximately 200,000; by the close of 1913 it had risen to 1,270,000; at the end of 1914, to 1,750,000.

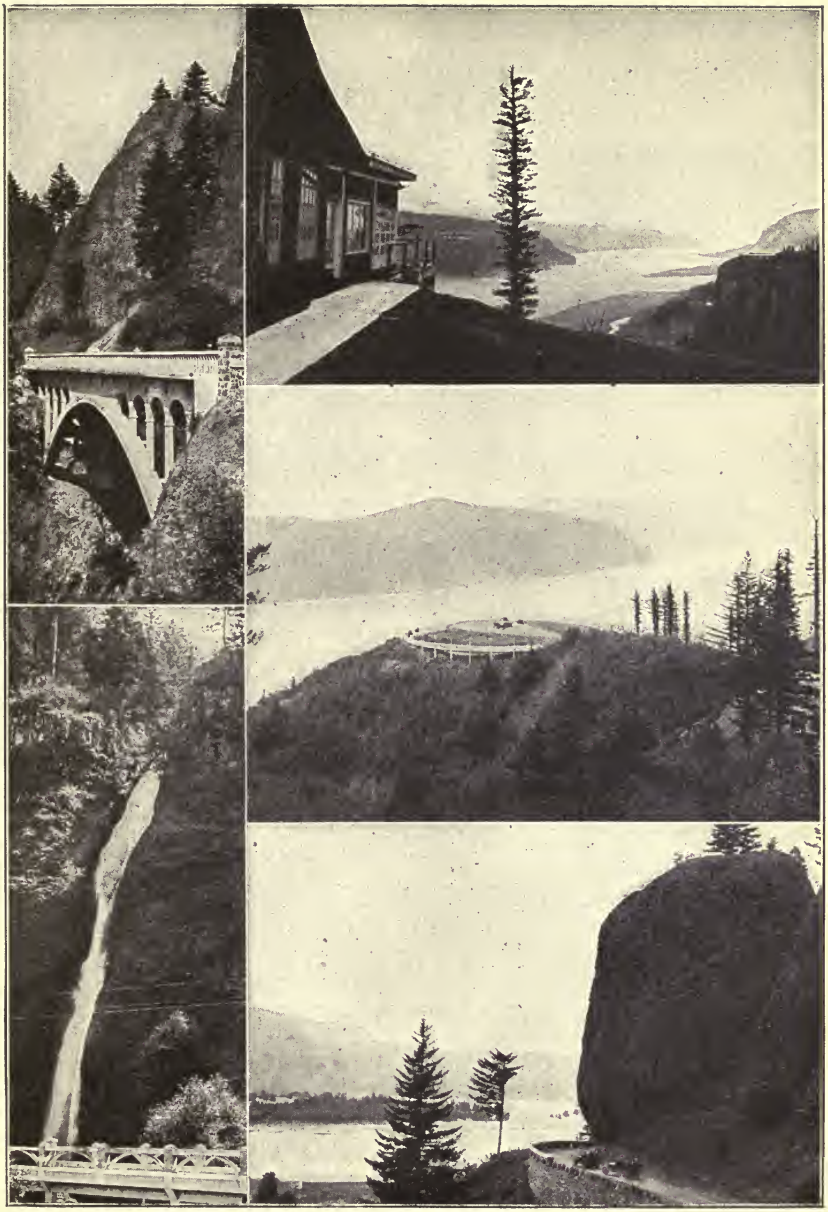
The number of deaths due to automobile accidents, and injuries, increased from 632 in the death-registration area in 1909 (containing 56 per cent of the population of the United States) to 2,623 in the same area in 1914; and the increase from 1913 to 1914, for the registration area as constituted in 1913, then containing 65 per cent of the population of the country, was from 2,488 to 2,795.

Thus a five-year increase of 775 per cent in number of machines has been accompanied by an increase of 315 per cent in automobile fatalities; and a one-year increase of 38 per cent in number of machines has been accompanied by an increase of 12 per cent in fatalities.

WRECKING TRUCK FOR ENGINEER CORPS SERVICE

AUTOMOBILE GENERAL REPAIR SHOP FOR ENGINEERING CORPS SERVICE

A more reliable comparison can be made between the increase in number of automobiles and the increase in the rate per 100,000 population for deaths caused by them. On this basis, a five-year increase of 775 per cent in number of machines has been accompanied by an increase of 258 per cent in the death rate resulting from automobile fatalities. Similarly, a one-year increase of 38% in number of automobiles has taken place along with an increase of only 10% in the death rate.



Views on the Columbia River Highway

WHAT THE ENGINEER HAS DONE FOR THE AUTOMOBILIST

Barges and Canal Boats Bringing Their Cargoes to the Seaboard
Automobiles and Boilers Have to Wait Their Turn

Loading Grain for Export
Congestion of Cars in Freight Yard

INDICES OF OUR VAST COMMERCE

CHAPTER XIX.

THE RECENT DEVELOPMENT OF AMERICAN COMMERCE

By SECRETARY OF COMMERCE WILLIAM C. REDFIELD

FOREIGN trade has in less than three years become one of the most important factors in the industrial life of our nation. The change has been so sudden that its significance is not fully understood even by all those directly interested. It is not merely that we have become, almost over night, the world's greatest trading nation. For a great many years we have ranked near the top, especially in exports. It is rather that our whole attitude toward foreign markets has changed. Our attitude now is one of enthusiasm, where formerly we were indifferent or only casually interested.

Once upon a time our foreign trading consisted of selling abroad our raw agricultural and mineral products and buying in turn such manufactured products as we needed. This sort of commerce can be carried on with little effort. As a matter of fact it never required much effort on our part and it never brought us in very close contact with the problems of world trade. We did not have an international point of view.

It was many years before American manufacturers found themselves in a position to export their products. From the start the home market was a rich one and one with which we kept pace only with difficulty. The first foreign shipments of any consequence were largely the result of "hard times" at home, which in the past have been almost periodical with us. The shipments abroad were an effort to keep the wheels in motion while the demand at home was slack. Considerable temporary success attended this departure, although the practice of supplying customers with products one year and disappointing them the next is not one that makes for cordial trade relations. Experience in foreign trade methods was gained, however, in this way and more than one manufacturer was led to establish permanent export departments. Some put their export business on a sound basis, while others began a sort of permanent "dumping" business abroad aimed to reduce overhead charges per unit on all goods manufactured. In the latter case the American consumer, however, derived no benefit from the increased efficiency resulting from the nearer approach to maximum capacity output, and the manufacturers themselves felt no real enthusiasm for foreign trade. It was not the proper way to win the place in world trade to which we are entitled by reason of our unparalleled resources, our capacity for industrial organization, and our intelligent and industrious workmen.

That the development of American commerce may be easily traced, a table is inserted here which shows the total exports and imports for a long period of years, and also the trade of our principal commercial rivals, the United Kingdom, Germany and France.

IMPORTS AND EXPORTS AND TOTAL FOREIGN TRADE OF THE UNITED STATES, THE UNITED KINGDOM, GERMANY, AND FRANCE FROM 1870 TO LATEST AVAILABLE YEAR

Year [1]	United States [1]			United Kingdom		
	Imports [2]	Exports	Total exports and imports	Net imports	Domestic exports	Total exports and imports
	1,000 dollars	1,000 dollars	1,000 dollars	1,000 dollars	1,000 dollars	1,000 dollars
1870....	435,958	392,772	828,730	1,259,270	971,285	2,230,555
1871....	520,224	442,820	963,044	1,316,417	1,085,551	2,401,968
1872....	626,595	444,178	1,070,773	1,442,250	1,247,075	2,689,325
1873....	642,136	522,480	1,164,616	1,535,123	1,241,760	2,776,883
1874....	567,406	586,283	1,153,689	1,518,304	1,165,809	2,684,113
1875....	533,005	513,443	1,046,448	1,536,811	1,087,497	2,624,308
1876....	460,741	540,385	1,001,126	1,552,501	976,410	2,528,911
1877....	451,323	602,475	1,053,798	1,659,316	967,913	2,627,229
1878....	437,052	694,866	1,131,918	1,538,476	938,500	2,476,976
1879....	445,778	710,439	1,156,217	1,487,884	932,090	2,419,974
1880....	667,955	835,639	1,503,594	1,692,939	1,085,521	2,778,460
1881....	642,665	902,377	1,545,042	1,625,227	1,138,873	2,764,100
1882....	724,640	750,542	1,475,182	1,692,695	1,175,099	2,867,794
1883....	723,181	823,839	1,547,020	1,758,043	1,166,982	2,925,025
1884....	667,698	740,514	1,408,212	1,591,720	1,134,016	2,725,736
1885....	577,527	742,190	1,319,717	1,521,312	1,037,124	2,558,436
1886....	635,436	679,525	1,314,961	1,428,945	1,035,226	2,464,171
1887....	692,320	716,183	1,408,503	1,473,961	1,079,944	2,553,905
1888....	723,957	695,955	1,419,912	1,574,766	1,141,365	2,716,131
1889....	745,132	742,401	1,487,533	1,756,714	1,211,442	2,968,156
1890....	789,310	857,829	1,647,139	1,732,331	1,282,472	3,014,803
1891....	844,916	884,481	1,729,397	1,817,943	1,203,170	3,021,113
1892....	827,403	1,030,278	1,857,681	1,748,875	1,105,749	2,854,624
1893....	866,401	847,665	1,714,066	1,682,882	1,062,161	2,745,043
1894....	654,995	892,141	1,547,136	1,706,023	1,051,191	2,757,214
1895....	731,970	807,538	1,539,508	1,737,270	1,100,453	2,837,723
1896....	779,725	882,607	1,662,332	1,876,402	1,168,669	3,045,071
1897....	764,730	1,050,994	1,815,724	1,903,165	1,139,830	3,042,995
1898....	616,050	1,231,482	1,847,532	1,994,730	1,135,643	3,130,373
1899....	697,149	1,227,023	1,924,172	2,043,897	1,287,151	3,331,048
1900....	849,941	1,394,483	2,244,424	2,238,071	1,417,086	3,655,157
1901....	823,172	1,487,765	2,310,937	2,210,112	1,362,729	3,572,841
1902....	903,321	1,381,719	2,285,040	2,251,128	1,379,283	3,630,411
1903....	1,025,719	1,420,142	2,445,801	2,301,985	1,415,179	3,717,164
1904....	991,088	1,460,827	2,451,915	2,339,493	1,463,410	3,802,903
1905....	1,117,513	1,518,562	2,636,075	2,346,821	1,605,052	3,951,873
1906....	1,226,562	1,743,865	2,970,427	2,544,138	1,827,737	4,371,875
1907....	1,434,422	1,880,851	3,315,273	2,695,388	2,073,300	4,768,688
1908....	1,194,342	1,860,773	3,055,115	2,498,119	1,835,176	4,333,295
1909....	1,311,920	1,663,011	2,974,931	2,595,597	1,840,415	4,436,012
1910....	1,556,947	1,744,985	3,301,932	2,795,785	2,094,467	4,890,252
1911....	1,527,226	2,049,320	3,576,546	2,809,909	2,209,972	5,019,881
1912....	1,653,265	2,204,322	3,857,587	3,080,022	2,371,073	5,451,095
1913....	1,813,008	2,465,884	4,278,892	3,207,800	2,556,106	5,763,906
1914....	1,893,926	2,364,579	4,258,505	2,925,550	2,096,105	5,021,655
1915....	1,674,170	2,768,589	4,442,759	3,674,009	1,871,886	5,545,895
1916....	2,197,884	4,333,659	6,531,543	.....	.....	.....

[1]Figures for the United States are for the fiscal years ended June 30; for the other countries they are for the calendar years.
[2]General imports.

IMPORTS AND EXPORTS AND TOTAL FOREIGN TRADE OF THE UNITED STATES, THE UNITED KINGDOM, GERMANY, AND FRANCE FROM 1870 TO LATEST AVAILABLE YEAR

Year	Germany [1]			France [1]		
	Imports	Exports	Total exports and imports	Imports	Exports	Total exports and imports
	1,000 dollars	1,000 dollars	1,000 dollars	1,000 dollars	1,000 dollars	1,000 dollars
1870	.....	.....	.....	553,400	540,800	1,094,200
1871	.....	.....	.....	688,400	554,400	1,242,800
1872	775,128	551,618	1,316,746	689,100	726,000	1,415,100
1873	893,176	542,085	1,435,261	686,100	730,900	1,417,000
1874	856,662	557,491	1,414,153	677,000	714,300	1,391,300
1875	839,590	593,052	1,432,642	682,600	747,400	1,430,000
1876	903,977	605,886	1,509,863	769,800	690,100	1,459,900
1877	896,972	656,982	1,553,954	708,300	663,200	1,371,500
1878	834,487	686,671	1,521,158	806,000	613,700	1,419,700
1879	896,618	660,352	1,556,970	886,900	623,600	1,510,500
1880	670,945	688,500	1,359,445	971,400	669,300	1,640,700
1881	705,013	707,978	1,412,991	938,600	687,400	1,626,000
1882	744,552	758,817	1,503,369	930,600	689,900	1,620,500
1883	776,476	778,257	1,554,733	927,200	666,200	1,593,400
1884	775,904	762,432	1,538,336	838,300	623,900	1,462,200
1885	699,067	680,551	1,379,618	789,100	596,000	1,385,100
1886	684,765	710,186	1,394,951	812,200	627,000	1,439,200
1887	740,511	745,896	1,486,407	777,000	626,600	1,403,600
1888	778,434	762,444	1,540,878	792,700	626,600	1,419,300
1889	949,520	753,222	1,702,742	833,200	714,900	1,548,100
1890	990,023	791,717	1,781,740	856,300	724,400	1,580,700
1891	987,890	755,771	1,743,661	920,200	689,000	1,609,200
1892	956,415	703,078	1,659,493	808,300	667,900	1,476,200
1893	942,894	735,886	1,678,780	743,800	624,600	1,368,400
1894	937,304	704,826	1,642,130	743,100	594,000	1,337,100
1895	980,719	789,660	1,770,379	717,900	651,100	1,369,000
1896	1,025,105	838,981	1,864,086	733,126	656,400	1,389,526
1897	1,114,006	865,124	1,979,130	763,508	694,405	1,467,913
1898	1,209,194	894,063	2,103,257	863,193	677,604	1,540,797
1899	1,304,977	1,001,278	2,306,255	872,032	801,459	1,673,491
1900	1,372,216	1,097,509	2,469,725	906,675	792,979	1,699,654
1901	1,290,254	1,054,685	2,344,939	843,256	774,498	1,617,754
1902	1,340,178	1,113,313	2,453,491	848,046	820,671	1,668,717
1903	1,428,640	1,193,483	2,622,123	926,632	820,685	1,747,317
1904	1,512,328	1,243,029	2,755,357	868,946	859,034	1,727,980
1905	1,696,660	1,364,131	3,060,791	922,329	939,305	1,861,634
1906	1,907,210	1,713,449	3,452,659	1,086,059	1,016,240	2,102,299
1907	2,081,066	1,629,163	3,710,229	1,201,031	1,080,047	2,281,078
1908	1,824,037	1,522,860	3,346,897	1,088,619	974,791	2,063,410
1909	2,027,790	1,568,954	3,596,744	1,205,500	1,103,584	2,309,084
1910	2,126,322	1,778,969	3,905,291	1,384,453	1,203,124	2,587,577
1911	2,309,947	1,929,243	4,239,190	1,556,705	1,172,834	2,729,539
1912	2,544,637	2,131,718	4,676,355	1,588,553	1,295,528	2,884,081
1913	2,563,331	2,402,967	4,966,298	1,642,117	1,326,950	2,969,067
1914	.....	.....	.....	1,235,619	939,685	2,175,304
1915	.....	.....	.....	.....	.....	.....
1916	.....	.....	.....	.....	.....	.....

[1] Special trade.

The decreasing relative importance of raw materials in our exports is shown in the following tables, the second of which sets forth in some detail the recent development:

AVERAGE ANNUAL DOMESTIC EXPORTS OF THE UNITED STATES AND THE PROPORTION OF RAW AND MANUFACTURED PRODUCTS, 1870 TO 1914

Period	Total Value	Foodstuffs		Raw Materials		Manufactures	
		Value	Per Cent of Total	Value	Per Cent of Total	Value	Per Cent of Total
1870–1879.	$530,155,600	$208,959,362	39.41	$211,010,501	39.80	$170,863,847	20.35
1880–1889.	748,011,563	335,463,721	44.85	259,012,052	34.63	150,055,277	20.06
1890–1899.	953,635,567	419,604,241	44.00	286,653,935	30.06	241,221,398	25.29
1900–1909.	1,555,067,656	499,351,477	32.11	460,922,051	29.64	585,713,271	37.66
1910–1914.	2,130,428,647	421,413,854	19.78	705,287,325	33.11	995,831,058	46.74

DOMESTIC EXPORTS FROM THE UNITED STATES, CLASSIFIED BY GREAT GROUPS ACCORDING TO USE AND DEGREE OF MANUFACTURE, DURING THE FISCAL YEARS ENDED JUNE 30, 1914, AND 1916

Great Groups	1914		1916	
	Value	Per Cent	Value	Per Cent
Crude materials for use in manufacturing	$792,716,109	34.03	$536,189,752	12.55
Foodstuffs in crude condition and food animals	137,495,121	5.90	380,799,902	8.91
Foodstuffs partly or wholly manufactured	293,218,336	12.59	596,071,882	13.95
Manufactures for further use in manufacturing	374,224,210	16.0C	662,549,838	15.51
Manufactures ready for consumption	724,908,000	31.11	1,996,367,492	46.73
Miscellaneous	7,122,249	.31	100,418,908	2.35
Total	$2,329,684,025	100.00	$4,272,397,774	100.00

The most important point in the foregoing tables is the fact that during the last two years we have shipped abroad a much smaller proportion of raw materials than formerly, and hence a greater proportion of manufactured goods. It is only natural that such a tendency should be viewed with the greatest satisfaction by Americans.

The destination of our exports during the last two years is a matter of the greatest importance, for it indicates to a certain extent what proportion of our newly found trade is temporary and what part of it may be retained if we determine to retain it and determine to give our best efforts to retaining it. In a table given below it will be seen that our exports to certain of the belligerent European countries have increased enormously since the war started, and of course much of this increase can fairly be attributed to munitions of war and to such supplies as are needed indirectly to maintain armies in the field. This includes explosives, shells, guns, and a percentage of the clothes, shoes, and so on that are now being shipped abroad in unprecedented quantities. Fortunately for all mankind, the demand for such material cannot go on forever, and when peace is finally made there will be

a falling off in such shipments, although not so suddenly perhaps as has been generally predicted.

The proportion of temporary business in our European exports has been exaggerated, however. It is erroneous to suppose, for instance, that the demand for pork and wheat and corn sold to England and France at this time is a temporary one brought about by the war. We have always sold such supplies in Europe, and it is not likely that the per capita consumption of foodstuffs in a country at war, outside of the army, is greater than it is in times of peace. Indeed it is very probable that in a war requiring great sacrifices on the part of the general population their per capita consumption may be decreased. It is not likely that the men actually at the front consume more food than they did before the war started. Shoes and other articles of wearing apparel are of course worn out more rapidly at the front than in ordinary walks of life, although there is a strong tendency on the part of the civilians at home to make such articles "go further" than ordinarily.

In considering our war time commerce with Europe and attempting to reach some conclusion as to the changes that will take place when peace is restored, it is well to bear in mind the fact that to counterbalance some of the inevitable losses there will be a greatly increased trade for some years with the nations that are now wholly or partly shut off from our markets. We ordinarily do a great business with the Central Powers, but after the war we shall be called upon to replenish depleted stocks in addition. This applies to Allied countries as well and perhaps to some of the neutrals. There will also be considerable reconstruction work in which the United States is well prepared to take part.

A table is given here to show what proportion of our war time exports is made up of military supplies. Our exports may be divided into three groups: (1) Exports of actual munitions of war, including cartridges, loaded projectiles, gunpowder, nitrotoluol, and other high explosives, cannon, rifles, etc.; (2) exports of what may be called secondary army supplies, including horses and mules, automobile trucks and aeroplanes, horseshoes, barbed wire, harness and saddles, men's boots and shoes, wool clothing and blankets, and brass, copper, lead, and zinc in pigs, bars and other manufactures; (3) exports of other products that have no direct relation to the war, including breadstuffs, meat and dairy products, cotton and its manufactures, agricultural and other manufactures of iron and steel, leather, mineral and vegetable oils, tobacco, lumber and other manufactures of wood, and other agricultural, mining and factory products that we sell abroad during normal times. The total increase in the articles included in the third class, which are normally exported in times of peace, forms practically one-half of the increase in our total exports. This fact is clearly brought out in the detailed figures in tables on pages 236 and 237.

Our trade with Europe, then, has recently developed to enormous proportions and there is a certainty that in some items there will be a falling off when munitions of war are no longer required; but there is also every reason to believe that in other lines there will be only a gradual decrease or no decrease at all. In some lines, as lumber and agricultural implements, an increase may be expected.

Our exporters and manufacturers have not failed to realize that an unprecedented opportunity for increased trade has existed for some time in countries outside of Europe, and the result is that to-day we are doing a larger business with South America, Asia, Africa and Australia than ever before. A larger share of our new business is with these countries than is generally supposed and it is a business to which too

EXPORTS OF MERCHANDISE FROM THE UNITED STATES TO EUROPE, CANADA, JAPAN, RUSSIA IN ASIA, AND OTHER COUNTRIES DURING THE FISCAL YEARS ENDED JUNE 30, 1914 AND 1916

Articles	Belligerent Europe		Neutral Europe		Canada, Japan, and Russia in Asia	
	1916	1914	1916	1914	1916	1914
Ammunition and firearms:						
Cartridges	$30,700,090	$567,211	$2,035,912	$11,093	$491,048	$384,667
Gunpowder	138,532,737	12,350	977,596	.....	33,573,981	46,865
Other explosives (except dynamite)	226,530,617	649	1,086,453	78,700	22,719,560	183,929
Firearms	11,425,914	679,518	487,954	60,226	4,536,424	557,882
Total	$407,189,358	$1,259,728	$4,587,915	$150,019	$61,321,013	$1,173,343
Articles mainly suitable for war purposes:						
Animals—						
Horses	$61,555,857	$420,376	.....	$800	$11,451,925	$2,396,552
Mules	17,607,497	27,000	184,400	.....	118,568	127,206
Brass, and manufactures of	133,577,834	3,425,929	3,025,359	176,607	26,378,551	2,970,450
Cars, carriages and other vehicles—						
Automobiles, commercial	50,486,097	240,712	436,832	8,004	4,208,008	475,624
Aeroplanes, and parts of	6,462,178	135,190	116,336	.....	338,649	29,845
Copper, and manufactures of	139,932,016	104,054,595	11,234,947	35,083,373	19,002,915	5,376,279
Iron and steel, manufactures of—						
Horseshoes	1,795,600	1,696	1,140	.....	248,074	22,941
Wire, barbed	14,815,481	65,171	8,274	58,795	5,353,873	508,741
Lead, manufactures of	4,134,541	1,162,624	1,225,762	393,913	6,558,261	501,576
Leather, manufactures of—						
Boots and shoes, men's	25,711,200	2,725,238	386,521	149,263	3,479,599	1,130,325
Harness and saddles	3,561,927	71,370	65,264	4,075	3,228,301	153,528
Wool, manufactures of—						
Wearing apparel	13,509,914	148,142	492,244	3,171	4,708,482	1,390,216
All other (except rags)	19,057,259	863,765	1,270,760	4,555	10,286,737	531,303
Zinc, and manufactures of	36,857,632	71,708	656,711	37,458	5,448,664	224,772
Total	$529,065,033	$113,413,516	$19,104,550	$35,920,014	$100,810,607	$15,839,358
Total above articles	$936,254,391	$114,673,244	$23,692,465	$36,070,033	$162,131,620	$17,012,701
Total other articles	1,709,781,266	1,185,135,204	356,380,410	150,620,248	510,106,742	380,124,306
Total exports	$2,646,035,657	$1,299,808,448	$380,072,875	$186,690,281	$672,238,362	$397,137,007

EXPORTS OF MERCHANDISE FROM THE UNITED STATES TO EUROPE, CANADA, JAPAN, RUSSIA IN ASIA, AND OTHER COUNTRIES DURING THE FISCAL YEARS ENDED JUNE 30, 1914 AND 1916

Articles	Other Countries		Total		Increase in Total, 1916 Over 1914
	1916	1914	1916	1914	
Ammunition and firearms:					
Cartridges	$3,856,438	$2,558,562	$37,083,488	$3,521,533	$33,561,955
Gunpowder	652,060	187,985	173,736,374	247,200	173,489,174
Other explosives (except dynamite)	2,031,761	653,002	252,368,391	916,280	251,452,111
Firearms	1,615,193	2,144,671	18,065,485	3,442,297	14,623,188
Total	$8,155,452	$5,544,220	$481,253,738	$8,127,310	$473,126,428
Articles mainly suitable for war purposes:					
Animals—					
Horses	$523,364	$571,091	$73,531,146	$3,388,819	$70,142,327
Mules	5,035,847	536,768	22,946,312	690,974	22,255,338
Brass, and manufactures of	1,894,300	899,490	164,876,044	7,472,476	157,403,568
Cars, carriages, and other vehicles—					
Automobiles, commercial	1,674,611	457,271	56,805,548	1,181,611	55,623,937
Aeroplanes, and parts of	84,842	61,114	7,002,005	226,149	6,775,856
Copper, and manufactures of	3,776,348	1,708,309	173,946,226	146,222,556	27,723,670
Iron and steel, manufactures of—					
Horseshoes	90,265	74,198	2,135,079	98,835	2,036,244
Wire, barbed	3,731,581	3,406,883	23,909,209	4,039,590	19,969,619
Lead, manufactures of	1,869,210	552,094	13,787,774	2,610,207	11,177,567
Leather, manufactures of—					
Boots and shoes, men's	7,292,646	6,113,139	36,869,966	10,117,965	26,752,001
Harness and saddles	674,228	557,482	7,529,720	786,455	6,743,265
Wool, manufactures of—					
Wearing apparel	657,861	606,706	19,368,501	2,148,235	17,220,266
All other (except rags)	2,717,117	268,576	33,331,873	1,668,199	31,663,674
Zinc, and manufactures of	2,904,149	72,270	45,867,156	406,208	45,460,948
Total	$32,926,369	$15,885,391	$681,906,559	$181,058,279	$500,848,280
Total above articles	$41,081,821	$21,429,611	$1,163,160,297	$189,185,589	$973,974,708
Total other articles	594,230,150	459,513,801	3,170,498,568	2,175,393,559	995,105,009
Total exports	$635,311,971	$480,943,412	$4,333,658,865	$2,364,579,148	$1,969,079,717

much importance can hardly be attached. If the war had ended in six months it is probable that many dealers in South America, for instance, would have returned to their old European connections, and while some may eventually return, no matter how long the war lasts, others have indicated that they are satisfied with their new American connections and will make no further changes. Some of our best lines of goods have now been on trial for some two years where previously they were practically unknown and they have established themselves permanently. The best American methods have also come to be understood where previously they were misunderstood. There are, unfortunately, a few American firms who have not realized their responsibility and have rushed in to take undue advantage of the necessities of foreign concerns. The trade done by such firms will not be retained when the war is over, but the bulk of our new business is not so done and can be retained if the proper enterprise is shown.

The surplus capital that has resulted from the sudden increase in our foreign business will, or should, prove the most effective factor in making the new business permanent. Formerly it was rare to have gold flow steadily to this side of the Atlantic, but recently it has not only flowed consistently in this direction, but in quantities that were never approached before in other countries. Wisely, much of this new capital has been invested in the newer and more undeveloped countries of the world. This will insure our having a hand in building railroads, establishing industries, constructing lighting and power plants, and so forth, and this in turn will make it certain that our manufacturers will share in the business of furnishing equipment for such undertakings. This is a new departure for American capital. It is a step that has long been recognized as necessary if we are to find good foreign markets for our most important products. Coming at the time when our exports to such countries are growing so rapidly, it can be taken as an indication that a large share of our new business is to be permanent.

A table is given here to show as simply as possible how our trade to the various corners of the earth has increased recently. It will be seen at once how important a share of our exports go to regions far removed from the war zone.

The growth of our trade with South America has appealed to the popular imagination more than that with any other district outside of Europe, and the assurance that a much larger business can be built

TOTAL VALUES OF EXPORTS FROM THE UNITED STATES TO DIFFERENT PARTS OF THE WORLD DURING THE FISCAL YEARS ENDED JUNE 30, 1914, 1915, AND 1916

Country	1914	1915	1916	Relative per cent of 1916 to 1914
Belligerent Europe	$1,299,808,448	$1,565,980,315	$2,646,037,657	203.6
Other Europe	186,690,281	405,454,372	353,145,772	189.1
Canada	344,716,981	300,686,812	466,884,415	135.4
Other North America	183,927,981	176,388,915	266,005,613	144.6
South America	124,539,909	99,323,957	180,356,555	144.8
Asia	113,425,616	114,470,493	278,470,228	245.5
Australia and Oceania	83,568,417	77,764,725	99,241,555	118.7
Africa	27,901,515	28,519,751	43,517,070	155.9
Total	$2,364,579,148	$2,768,589,340	$4,333,658,865	183.3

up with our nearest neighbors and can be retained has not only concentrated the attention of manufacturers and exporters on South American markets and the problems connected with entering them to advantage, but has, for the first time in our history, aroused an ambition in many young men to learn the language and customs of the countries that lie to the south of us. There are hundreds of young men now preparing for careers in foreign trade where formerly there was one, and South America more than any other section has been the lodestone. If this sudden interest does nothing more than prepare young Americans for the export trade it will have been worth while.

The trade with the individual South American countries in 1916 as compared with 1914, the year preceding the war, deserves careful study. This country sold Argentina $65,993,611 worth of goods in 1916, whereas in 1914 our total sales amounted to only $45,179,089. Imports from Argentina increased even more rapidly, for in 1916 we purchased $112,512,420 worth as compared with $45,123,988 worth in 1914. The imports were as usual raw materials. Exports to Bolivia showed only a slight gain—from $1,145,555 to $1,367,891—while our imports from that country amounted to $204,904 as compared to practically nothing before the war. Exports to Brazil show an increase from $29,963,914 to $41,202,277, an encouraging development that holds much promise for the future. Our purchases from Brazil increased from $101,329,073 in 1914 to $132,663,984 in 1916. Chile bought $17,432,392 worth of goods from the United States in 1914, but in 1916 the amount spent with us had increased to $24,289,652. We in turn greatly increased our purchases in Chile, the figures being $25,722,128 in 1914 and no less than $64,154,859 in 1916. Our exports to Colombia increased from $6,786,153 to $11,125,232 and our purchases increased from $16,051,120 to $21,458,029. Sales to Ecuador, while not so important as they ought to be, increased from $2,967,759 in 1914 to $3,462,040, and purchases rose from $3,595,456 to $5,848,290 in 1916. Paraguay is the one country with which business, both import and export, has fallen off. Our exports to that country amounted to only $173,191 in 1914, but in 1916 they had fallen off to a mere $73,452. Similarly, our imports fell from $64,651 in 1914 to $53,337 in 1916. Exports to Peru increased from $7,141,252 to $10,173,176 and imports from that country increased from $12,175,723 to $24,326,689. Our trade with Uruguay has resembled that of Peru so far as quantity goes, our exports in 1914 amounting to $5,641,266 and in 1916 to $10,274,426, whereas our imports increased from $7,715,144 to $14,475,478. Figures for Venezuela are also somewhat similar, our exports to that country increasing from $5,401,386 in 1914 to $8,999,272 in 1916, and our purchases showing a jump from $9,763,069 to $14,942,448.

The foregoing figures are significant not only in showing that our exports to South American countries have increased in a satisfactory manner in the last two years, but also in calling attention to the fact that these countries are now selling a greater quantity of goods in this country. Our purchases consist of such essential raw materials as coffee, rubber, tin ore, nitrates and hides, which we need in large quantities. Before the war much of the rubber, all of the tin, and some of the hides went to Europe, there to be manufactured and shipped across the Atlantic again to the United States. Probably when the war is over the European countries will import all the raw materials they need direct from South America, but it is very unlikely that they will ever again supply us extensively with goods manufactured from South American materials. This condition not only makes for greater independence on our part, but brings us

into much better relation to the South American countries.

The growth in our export trade has been more rapid than the growth in our imports and is a subject that is much more interesting to most Americans. It is quite natural to dwell at greater length upon what we succeed in selling than upon what we have to buy. Nevertheless the recent great growth in our purchases abroad is significant and deserves the most careful study. In 1914 we purchased abroad $1,893,925,657 worth of goods, which is not far from normal, but in 1916 we spent no less than $2,197,883,510 for foreign products. The table that follows shows the purchases made by the United States since 1904, by continents.

It will be seen that imports have fallen off from Europe only. It has been impossible for the manufacturers in the belligerent countries to concentrate on their foreign trade as they did before the war; so, in spite of the fact that we have had more money to spend than ever before, our purchases of manufactured goods from Europe have fallen off. In many quarters this fact is looked upon as a favorable one, inasmuch as it has resulted in a tendency to rely more on our own industries. Certainly our American ingenuity has had plenty of opportunity of proving itself. We are now successfully manufacturing many lines of goods that were formerly exclusively imported.

From other parts of the world, however, we are making heavier purchases than ever before, but such purchases, as in the case of South American countries already mentioned, have been very largely raw materials, which formerly we imported indirectly in an unmanufactured state through European middlemen or were manufactured for us by European manufacturers. This establishment of direct relations with the newer and more undeveloped countries of the world will be most helpful, not only in saving freight charges and in doing our own work in our own factories, but in effecting closer trade relations with the producing countries. An idea of the part played by raw materials and manufactured goods in our import trade since 1870 may be had from the two tables on page 241, the second table showing in some detail the changes that have taken place in the last two years.

It will be seen that the recent trend of our import trade does not threaten American interests. We are making more and more of the manufactured goods we need, and importing more and more of the raw materials that formerly were

PURCHASES MADE BY THE UNITED STATES, 1904-1916

Fiscal Years Ending June 30—	Imports					
	Europe	North America	South America	Asia and Oceania	Africa	Total
	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars
1904	498,697,379	198,778,952	120,364,113	163,820,151	9,426,776	991,087,371
1905	540,773,092	227,229,145	150,795,800	187,371,412	11,343,622	1,117,513,071
1906	633,292,184	235,353,322	140,422,876	204,865,329	12,628,735	1,226,562,446
1907	747,291,253	263,576,349	160,165,537	242,260,820	21,127,466	1,434,421,425
1908	608,014,147	238,815,898	124,998,590	206,222,482	16,290,675	1,194,341,792
1909	654,322,918	253,999,920	163,878,724	224,610,035	15,108,627	1,311,920,224
1910	806,270,280	306,767,486	196,164,786	230,255,139	17,489,739	1,556,947,430
1911	768,167,760	305,496,793	182,623,750	243,724,182	27,213,620	1,527,226,105
1912	819,585,326	334,072,039	215,089,316	261,932,365	22,585,888	1,653,264,934
1913	892,866,384	361,943,659	217,734,629	314,038,218	26,425,344	1,813,008,234
1914	895,602,868	427,399,354	222,677,075	329,096,884	19,149,476	1,893,925,657
1915	614,354,645	473,079,796	261,489,563	300,292,655	24,953,081	1,674,169,740
1916	612,252,709	591,895,543	391,562,018	533,407,455	64,765,745	2,197,883,510

manufactured for us by other countries. For the most part the raw materials imported are such as we can not produce at home or can not produce in sufficient quantities to meet the demand.

Another development of the last two years is our transition from a debtor to a creditor nation. At least it can safely be said that we are now a creditor nation so far as current accounts go. This has been the result, of course, of shipping abroad here at home, but much of it has been invested in foreign securities, as already mentioned. Just how much has been so invested can only be estimated, but about the middle of 1916 the figure was put at nearly a billion and a half of known investments, with many other proposed loans under consideration. The largest loans have been made to the belligerent countries, but a steadily increasing amount is going into the more undeveloped countries

AVERAGE ANNUAL IMPORTS INTO THE UNITED STATES AND THE PROPORTION OF RAW MATERIALS AND MANUFACTURED PRODUCTS, 1870 TO 1914

Period	Total Value	Foodstuffs		Raw Materials		Manufactures	
		Value	Per Cent of Total	Value	Per Cent of Total	Value	Per Cent of Total
1870–1879.	$512,021,878	$189,618,034	37.03	$74,245,895	14.50	$238,691,827	46.62
1880–1889.	680,050,955	224,892,472	33.07	132,740,135	19.52	311,078,907	45.74
1890–1899.	757,264,781	261,688,223	34.56	185,512,723	24.50	303,883,186	40.01
1900–1909.	1,087,799,986	266,573,229	24.51	357,425,263	32.86	456,177,165	41.94
1910–1914.	1,688,874,472	397,517,016	23.54	580,339,002	34.36	696,400,401	41.23

IMPORTS INTO THE UNITED STATES, CLASSIFIED BY GREAT GROUPS ACCORDING TO USE AND DEGREE OF MANUFACTURE, DURING THE FISCAL YEARS ENDED JUNE 30, 1914 AND 1916

Great Groups	1914		1916	
	Value	Per Cent	Value	Per Cent
Crude materials for use in manufacturing	$632,865,860	33.42	$944,105,228	42.96
Foodstuffs in crude condition and food animals	247,947,621	13.09	251,833,794	11.46
Foodstuffs partly or wholly manufactured	227,644,329	12.02	309,708,717	14.09
Manufactures for further use in manufacturing	319,275,488	16.86	359,441,501	16.35
Manufactures ready for consumption	449,318,214	23.72	315,353,634	14.35
Miscellaneous	16,874,145	.89	17,440,636	.79
Total	$1,893,925,657	100.00	$2,197,883,510	100.00

so much more than we have been importing, which has enabled us to establish credit abroad, to buy up American securities held in European countries, and to import unprecedented quantities of gold. Much of this newly acquired capital has been used for development purposes for development purposes. The purchase of American securities held abroad has proceeded rapidly during the last two years and it is safe to say that the total amount of paper so repurchased reaches well over a billion dollars. Some estimates have put it as high as two billions.

More accurate statistics are to be had on the imports of gold. The net inward gold movement aggregated $456,032,344 for the twelve months ended September 30, 1916. For the year previous the total was $205,440,751, showing that the net inward movement has doubled within a year. More gold has been added to our store in two years than has ever been added to the supply of any nation before in the same length of time, and despite all pessimistic predictions it seems only reasonable to suppose that this vast accumulation will be a powerful factor in enabling the country to hold its own in the world's commerce no matter what circumstances may arise. It will enable us to maintain ourselves in foreign markets on a much better footing than ever before and will enable us to meet without embarrassment any foreign demands for gold.

Mention has already been made of the fact that we have been dealing more directly with some of the producing countries. A few special instances will be of interest in this connection. For a great many years previous to the war the world's furs were sold through London and Leipsic. Our furs, which are mostly seal, were sent all the way to London to be sold, and not until they had been auctioned off and dressed and dyed did we see them again, greatly enhanced in price as the result of two trips across the Atlantic, duties, and foreign labor. Furs trapped in Northwestern Canada likewise were shipped across the continent, across the Atlantic, and back again to us. The war gave us the opportunity of organizing fur sales in this country, with the assistance of the Government, and we have learned to dress and dye our furs quite as well as anybody ever did it for us. We now buy the fur skins direct from the countries in which they are trapped, and very likely we shall continue to do so when the war is over.

We are buying more rubber direct now than we ever did before, and there seems to be no reason why we should go back to European middlemen in the future. One of the most important developments in the way of direct buying has been the purchase of tin ore from Bolivia. We mine no tin in this country and have always been content to have England and Germany get the ore from the Straits Settlements and Bolivia and refine it for us. As a result of the difficulties encountered in getting tin in this manner under war time conditions, a company was organized in this country to buy ore direct from Bolivia and smelt it in this country. Fifteen tons of the refined metal a day are now produced here, and it is tin of the very best quality. This direct dealing with Bolivia can not help stimulating commercial relations between the two countries. In short, it may be said that this country will never in the future be wholly satisfied with indirect buying arrangements.

Another interesting phase of our new position in world's trade is the increasing tendency to substitute dollar exchange for sterling exchange. Perhaps it is premature to say that the substitution is or is not going to be permanent, but it is safe to say that the experiment, even if merely tentative, has had the effect of bringing our merchants into much closer touch with the merchants of other nations than ever before. The establishment of branch banks in South America is another important step that has been taken recently in an effort to put our dealings with our South American neighbors on a more satisfactory basis.

In conclusion it might be said that the pre-eminent position which the United States has come to occupy in the last two years has then been of inestimable benefit in stimulating the industries of the country, in giving us an international point of view, and in making it possible to get into closer touch than ever before with the manufacturers, ex-

porters, merchants, importers and bankers of other countries, and it is highly desirable that we do not let slip the advantages we have gained. It is not desirable, of course, that we go on exporting twice as much as we import, for international trade can not be conducted on any such basis for an indefinite period, but it will be greatly to our advantage to remain the first commercial nation and to retain the best of the great business so recently acquired. It can be done if American business men determine that it must be done, if they realize fully the importance of foreign trade. They can not do it if they return to the indifferent methods that prevailed when the home market was looked upon as all-sufficient.

The necessity of foreign trade need not be dwelt on in an article of this kind. Even the layman has had the opportunity in the last two years of seeing what wonders a thriving foreign business can accomplish. The fact that our sales abroad do not comprise more than 1 to 5 per cent of our sales at home does not mean that the foreign sales are of trifling importance, as was once commonly assumed. The point is that the sales to outsiders are large enough to mean the difference between stagnation and prosperity. They are so important that our manufacturers cannot afford to let them fall off, and it is my opinion that they will not allow any but the most temporary part of our new business to get away from them.

RACINE REEF LIGHTHOUSE IN WINTER GARB

MODERN METHODS OF ORE HANDLING IN THE HOLD OF A SHIP

CHAPTER XX.

COMMERCIAL AND INDUSTRIAL PREPAREDNESS

By Dr. EDWARD EWING PRATT

CHIEF OF THE BUREAU OF FOREIGN AND DOMESTIC COMMERCE, DEPARTMENT OF COMMERCE

WE are indebted to the great European war for the slogan "Preparedness." The word was in the dictionary before hostilities began, but it lacked any real vitality. Americans had always assumed that they were pretty well prepared for almost any eventuality, as individuals and as a community. If we needed to fight we had a population of a hundred million to fall back on; if we ever came to a pass where we needed more foreign trade, we could go out and get it; if we needed to make things that others had always made for us, all we had to do was make them. We were living in a fool's paradise.

We know now that we were not adequately prepared to do anything but drift and muddle along rather prosperously by virtue of immense resources, favorable geographical situation, and a native ingenuity and resourcefulness which we had inherited from our pioneer ancestors. What we have learned about the necessity of military preparedness will not be discussed here. This article will be concerned with preparedness for the commercial struggle which will come when peace is declared and with the preparations we are making and must make to achieve industrial independence of the older manufacturing nations of Europe.

As has been said many times, we have become the leading commercial nation of the world. This is not only true, but is becoming increasingly evident with the passing of each month. In August and September, 1916, our exports exceeded half a billion dollars, which is not only a higher figure than we ever reached before, but is much larger than any nation ever achieved before. Our imports have also grown rapidly, but the balance of trade in our favor has attained enormous proportions and our industrial prosperity is so pronounced and so real that the most carping critics no longer question it. The question is, can this great trade and this great prosperity survive the war?

It is certain that we cannot retain all of the present trade and it is not at all certain that we can continue as prosperous as we have been throughout 1916. But it is certain, I think, that we need not suffer so serious a disturbance when peace is declared as has been pictured in some quarters. We have acquired much new business that can be retained if we make the proper efforts to retain it, and as the war goes on our opportunities for acquiring more business of that sort increase. We need a thorough appreciation of the necessity of keeping our hold on as much of our newly acquired trade

as possible when the war is over.

We on this side of the Atlantic are under the necessity of holding our own in foreign markets if we are to avoid difficulties when the war orders cease, and it is well to bear in mind that the belligerent nations will be under the necessity of winning back their old markets if they are to meet the obligations they have incurred in the war. It will be a bitter fight, with no quarter asked and no quarter given. Our competitors will not only try to oust us from our foreign markets, but undoubtedly will carry the fight right into our home markets.

In planning to meet this struggle we must consider conditions that will arise immediately upon the cessation of hostilities and also the more permanent conditions resulting from the war. A number of our important industries will be disarranged when peace is made. Manufacturers of munitions and other supplies needed by the armies are well aware of this fact, but there are two classes of manufacturers who are not facing the facts. One class is manufacturing the materials that go into the munitions and the other is turning out goods that are not munitions, but which are required for military purposes. Such manufacturers should determine just how much their business has been stimulated by the war, and they should carefully charge enlargements of plant and equipment against present profits. It will be necessary also to keep in mind the fact that soon after peace is made there will be decided changes in the trade routes of the world. There will be important readjustments in the principal markets. It will be an important matter for us to have a large influence in determining these changes.

The permanent effects of the war are of equal importance to us. The European nations will be compelled to seek foreign markets as they

THE CZAR OF RUSSIA AND MILITARY OFFICERS WITH AMERICAN BUILT RED CROSS AMBULANCE IN THE FOREGROUND

never sought them before. But let us consider carefully under what conditions they will be obliged to seek them. Will they be as formidable after the war as they were before? There has been a wide difference of opinion among economists as to how the cost of production in Europe after the war will compare with what it was before the war, but the longer the war continues the better agreed are the authorities that costs as a whole will be higher. There has been a tremendous loss of men, of labor power. Millions have been killed and other millions incapacitated. In almost all the belligerent countries there has been a rapid and steady diminution of capital. It has been used up in destruction instead of production. Taxes are certain to be excessive for years to come, for immense debts have accumulated. Fiscal affairs will be disorganized. These facts are given here to show that the increased cost of production in our country should not be considered an insurmountable handicap in the coming struggle. The point is that we are confronted with no insurmountable difficulties. There is no circumstance which definitely debars us from holding our own when the test comes.

The problems in foreign trade which we must work out are difficult ones, however, and deserve our most careful attention, for the stability of our prosperity will depend almost entirely upon our success in such trade. It was our foreign trade which was interrupted when the war broke out, and it was this interruption which threatened the most serious economic consequences. The war taught us that our domestic prosperity is most vitally concerned with the prosperity of our foreign trade, and it is for success in this foreign trade that we must carefully plan. Let us consider a number of important factors that will have a bearing upon our success in such trade.

First of all comes the question of men properly prepared to carry on our business with and in foreign countries. We have never had an adequate supply of such men. The young American has never seriously considered preparing himself for such work. Other fields have appeared more attractive to him. Where we have had one capable man for such work the English and Germans have had dozens or perhaps hundreds. We must set about painting the advantages of the foreign field in their proper colors and we must at once concern ourselves with training men in a practical, efficient manner. We must have men who know business, who know their own particular business, who know foreign languages, who know how to sell goods, and, above all, men who can go into foreign markets with a sympathetic point of view. For the foreign field we need men who are diplomats as well as drummers.

We must also pay more attention to financing foreign trade. We must familiarize ourselves not only with the extension of credits, the establishment of branch banks, the discounting of paper, but with the whole mechanism of foreign exchange and the investment of American capital in foreign countries. Of such things most of us have known very little. We must be willing and able to provide funds for the construction of public utilities, factories, mining plants, warehouses, and other public improvements.

The establishment of a conventional tariff system is another factor that will be necessary in our campaign for foreign trade. Many nations are able, by reason of their tariff systems, not only to prohibit the sale of or to handicap the importation of commodities from economically unfriendly nations, but they are also able to encourage the exportation of their own commodities by advantageous bargains with countries which are economically friendly. A conventional tariff sys-

tem is simply a tariff system with an international point of view.

It is also important that we prepare to become the market place of the world for certain staple commodities. In the past we have been content to purchase our rubber, tin, wool, furs and so on through England and Germany. It is necessary that we handle some of these supplies ourselves. We must prepare the machinery for handling them economically—the facilities for grading the articles, for buying and selling, for settling disputes, and so on. We have already made some satisfactory progress in this direction, and there is no good reason why we should ever go back to the old way of buying through European middlemen.

One of the most important factors in our campaign will be our merchant marine. We are turning out new tonnage more rapidly now than any other nation, and we should continue to do so. Large accessions to our merchant fleet have resulted from the Ship Registry Act. We have heard many opinions to the effect that our navigation laws are antiquated and operate to the disadvantage of American boats, yet there is no important difference between our laws and those of other important maritime countries, and there will be fewer differences as time goes on and certain European countries have an opportunity to carry out plans formulated a short time before the war started.

So much for some of the important factors we must bear in mind in making our preparations. Now let us consider some of the steps already taken.

Thanks to the Federal Reserve Act our financial resources are for the first time in our history mobilized for foreign trade.

To the Federal Trade Commission we can look for guidance in the matter of co-operating in foreign trade. This commission will also see to it that we are protected from unfair competition in our own markets on the part of foreign manufacturers.

A Tariff Commission has been authorized by Congress. The benefits that will come from a scientific, non-partisan commission of this sort are too numerous to mention. In forming this commission we have taken one of the most important steps in the direction of commercial preparedness.

A Shipping Board has also been brought into being. For the first time in our history we now have an efficient instrument for shaping the growth and policies of our merchant marine.

Definite and constructive work in advancing our trade frontiers is being done by the Bureau of Foreign and Domestic Commerce, of the Department of Commerce. This bureau collects information about foreign markets for American goods. The sources are the consuls, the newly appointed commercial attachés, and a corps of traveling special agents. The office at Washington is the warehouse, and the staff there and at the district offices is engaged in selling the information for action. Action is the price and results are the object of our work. The Bureau is rapidly improving in efficiency.

Private corporations have been organized for financing foreign enterprises and large sums of American capital have been made available for use in countries that formerly depended entirely upon European financiers. Nothing will stabilize our newly acquired foreign trade quite so effectively as the appearance of American gold.

The lumber manufacturers of the West have organized an export sales company to assist in the sale of Douglas fir in foreign markets. This company will undertake the grading of lumber for export, the proper seasoning of such lumber, and an extensive propaganda. It is one of the most intelligent steps that any American industry has taken in this

direction. It should be studied carefully by every other industry desirous of taking steps to insure itself against disaster when the war is over.

There is much that remains to be done before we can look forward with complete assurance that when the war is ended we shall be able to hold the trade we have recently acquired in the world's markets. We are still in the midst of busy preparations for the future, or should be. We cannot prepare too carefully, because failure will mean a depression from which it may take years to recover.

There is another phase of industrial preparedness quite distinct from that concerned with holding our own in foreign markets. I mean preparedness to produce here at home all articles that are essential to our well being. We must make ourselves independent of the manufacturers of foreign countries. That does not mean that we must sever all relations with foreign manufacturers, but it does mean that we should be in a position to get along without them if need be—if there should be another great war between the important manufacturing countries of Europe or if we should get into such a war ourselves.

In a large measure we are already independent. If intercourse with every other nation in the world were cut off, we could manage to get along. We could produce sufficient food for everyone and sufficient clothing and fuel. Our iron and steel industry is practically self-contained. Building materials we have in plenty. There would be no suffering for lack of real necessities. Inconvenience and annoyance there would be though, and, if we were involved in a great war ourselves, perhaps a serious shortage of some materials essential for the manufacture of munitions. We depend upon other countries for many lines that we would sorely miss. We know it now, for we have missed them during the last two years. Are we going to be in the same position some time in the future?

We have made considerable progress in establishing new industries to supply goods formerly made for us by Europe and in expanding old industries to meet the war-time demand for such goods. These new industries have resulted either because certain lines of goods formerly received from the Central Powers and Belgium have been cut off altogether or because accustomed supplies from the Allies have been greatly reduced by the shortage of ships. In either case we are learning to manufacture goods that we previously purchased abroad and this experience will undoubtedly, in the long run, be of more real benefit to the country than the temporary munitions business.

Our principal purchases from Germany, in the order of their value, have been hides and furs, cotton manufactures, dyes and chemicals, machinery and other manufactures of iron and steel, potash, pottery, silk and silk manufactures, toys, glacé leather and glacé-leather gloves, rubber, paper and paper manufactures, and salt. Germany had a practical monopoly of several of these classes—such as dyes and certain chemicals, potash and toys. It seems hardly necessary to say that the cutting off of these lines was a serious matter for us. We soon realized that we must make a serious effort to manufacture our own coal-tar products and at least a certain amount of our own potash.

How well we have succeeded with the coal-tar dyes is pretty generally known. Not every user of dyed goods is wholly satisfied that the quality of our dyes is yet all that it should be, but it should be borne in mind that the demand on the hurriedly built plants was enormous and that in some cases it was inevitable that quantity rather than quality should be given first consideration. Improvement in quality

has taken place steadily, however, and it is not likely that much more fault will be found in that direction. We are now producing about half the ordinary requirement of some 29,000 tons annually and the difference has been partly made up by the use of natural dyes. Congress has accorded protection to the new industry in the shape of additional tariff and the Bureau of Foreign and Domestic Commerce has supplied a detailed census of the dyes we imported in normal times. This census is aimed to assist manufacturers in determining how much of each color is actually needed by the dye users of the country. Previous to the publication of this work only our dyestuff importers had any such knowledge of the market. One Buffalo manufacturer has stated that the census has saved him a million dollars and years of wasted effort.

There are a number of other coal-tar products for which we formerly depended upon foreign manufacturers, including carbolic acid, aspirin, acetanilid, photographic developers, salicylic acid, saccharin, creosote and benzoic acid. These are all manufactured at home now, although not in the quantity that might be wished. Prices are very high. But we have demonstrated our ability to manufacture them and it is not likely that we shall allow the experience to go for naught.

The lack of potash has been a sore point. The German deposits can be worked so cheaply that in the past there has been no incentive to recover the material from kelp, alunite or other sources, but when the German supply was cut off there began an eager searching of our own resources. The result has been that we have made considerable progress in recovering potash from kelp, alunite, the brine of certain alkaline lakes, tobacco stems, mica and in the manufacture of Portland cement. The supply has been barely sufficient for industrial use, however, and our fields have had to do without it.

But our children have not been obliged to do without toys. American ingenuity stepped in quickly when the supply of German toys was cut off and so far as novelty

AGRICULTURAL FAIR AT JOHANNESBURG, SOUTH AFRICA, SHOWING AMERICAN MOTOR CARS AND AGRICULTURAL IMPLEMENTS

goods are concerned we are better supplied now than ever. Good progress has also been made in imitating typical German products, and it is not at all likely that Santa Claus will ever again import heavily from abroad to fill our stockings. As a matter of fact we are doing some foreign business in this line ourselves and satisfactory relations have already been established with dealers in England, Australia and South America.

We are now importing tin ore from Bolivia and doing our own smelting. Formerly we depended almost entirely upon England and Germany for our refined tin. These countries bought their supplies of ore and partly refined tin from the Straits Settlements and Bolivia and did the work of completing the refining for us. The war interfered with getting the supply in this manner and a firm was organized to import the ore from Bolivia and smelt it in this country. The new plant is now turning out fifteen tons of the finest tin a day. We need about 45,000 tons a year.

An attempt is being made to establish an all-American linen industry. For years before the war started the United States was the greatest consumer of linen goods in the world and practically all such goods were purchased abroad. The war has greatly interfered with these imports, for Russia is by far the greatest producer of the raw flax fiber required by the Irish, Belgian and French mills. In this country flax has been raised almost entirely for the seed, which is used to manufacture linseed oil, and the Department of Agriculture has estimated that in 1915 there were some 3,000,000 acres devoted to this crop. Of this great total only 2,000 acres were planted in flax for fiber, the yield for this purpose being estimated at only 4,000,000 pounds. It should be kept in mind that flax growing for seed and flax growing for fiber are two separate and distinct industries. To some extent flax is grown for both seed and fiber, but the farmer must decide which is to be the main product and which the by-product, just as the sheep raiser must decide whether wool or mutton is to be the main consideration when he selects the stock he is to raise. In Russia the flax grower not only raises the flax but prepares the fiber for the mills, and this is a disagreeable and insanitary process and one that depends upon very cheap labor. The problem in this country was to find a satisfactory chemical process of preparing the fiber that could be carried on in a factory. Such a process has apparently been worked out, for several important concerns are now buying flax on a large scale in the West. They are also assisting the farmers in a financial way. The manufacture of the coarser goods from this straw is now being carried on successfully and in time the high-grade linens will be made also, in spite of the reputation of foreign makes. In the past our foreign linen bill has been somewhere between 25 and 30 million dollars annually.

The manufacture of certain lines of cotton goods has expanded in a surprising manner since the war started. There has been a marked increase in the production of fine count and novelty fabrics and manufacturers have demonstrated their ability in designing and finishing such goods. Embroidery cotton, both mercerized and plain finished, heretofore produced almost exclusively abroad, is being made satisfactorily by domestic spinners. There has also been an increase in the manufacture of brass bobbin yarn for lace manufacturers. The large demand for all fine counts, combed, gassed and mercerized yarns has forced a considerable increase in production. Scrubbing, wiping and allied cloths produced with yarns spun from cotton waste, and hereto-

fore imported largely from Germany and Austria, are now made in this country.

The shutting off of the supply of full-fashioned hosiery formerly imported from the Chemnitz district in Germany has greatly stimulated the production of such hosiery in this country, as well as some grades of fine-gaged seamless hosiery. The shortage of dyes has been the only obstacle in the way of completely meeting the demand for the best grades of hosiery.

The only large artificial-silk plant in this country has doubled its capacity since the war started and it is said that several other such plants are to be started.

Several firms that previous to the war imported loopers and flat bar knitting machines have started the manufacture of these articles.

Before the war this country depended almost as a matter of course upon German and Austrian sources for sugar-beet seed with which to keep going our flourishing young beet-sugar industry. Ordinarily the consumption of such seed in this country is about 135,000 bags, or approximately 15,000,000 pounds, and this is almost exactly the amount of seed we imported in 1913. It is estimated that the production of seed in 1916 was 60,000 bags and that in 1917 we shall have a yield of 85,000 bags. The present producers assert that they are going right ahead until it is no longer necessary to depend upon outside sources.

An American industry with a million dollar market has come into existence as a result of cutting off the imports of petroleum from Russia. By the end of 1914 at least a score of American refiners were experimenting in the new field and at least ten sources of domestic white oil for medicinal purposes were developed. These new American products are quite the equal of the Russian product and will probably hold the market permanently.

The war found us unprepared to manufacture enough lanolin, or refined wool grease, to meet the demand. Ordinarily we import about 12,000,000 pounds of crude wool grease and 2,500,000 pounds of lanolin. The domestic production of crude grease is about 6,000,000 pounds, but very little lanolin has ever been made at home. We have always used the crude grease in tanneries, cordage factories, etc., and left to others the work of preparing the refined wool fat, so valuable in salves, ointments and emulsions. Now we are at work doing our own refining.

A well-known St. Louis firm is dressing and dyeing 10,000 sealskins by a process formerly used only in England. The plant is being expanded. In the past we sent the skins to London for dressing and dyeing, in spite of the fact that we are the largest producers of sealskins in the world and the largest consumer. The first sale of fully dressed and dyed sealskins wholly "made in America" ever held in this country took place in October, 1916. We shall never go back to the old way of carrying on this business.

Within the last two years there has been introduced into this country the chemical porcelain industry, with the help of the Bureau of Standards. Only a short time ago there was not an American manufacturer who believed chemical porcelain could be made from American materials in American factories. Now two establishments are making the best type of modern chemical porcelain.

In the past much of the clay used in this country in the manufacture of porcelain came from England, that for the manufacture of crucibles and other high refractories from Germany, and that required for other fine products from France. Experts in the Department of Commerce have pointed out that clays for all these purposes may be obtained in the United States and by

proper treatment be made equal and in many cases superior to the material heretofore supplied by Europe. Many of these clays are found in the South and are now being used commercially.

Before the war all naphtha and gasoline safety lamps were purchased in Europe. Since the war started some of the foreign patents have expired and several American lamps of this type have been placed on the market. With the help of the Bureau of Mines there have also been developed several types of permissible electric safety lamps, which are now in the market in competition with foreign makes.

The war has had a very stimulating effect on the production of crude and calcined magnesite in California. In times past these deposits have been used very sparingly, and principally in connection with the paper industry. In 1913 the imports amounted to approximately 168,000 tons, while the domestic production did not reach 10,000 tons. The imported material was largely used in the manufacture of refractory furnace lining and in the manufacture of paper from wood pulp. No exact data as to the present output of the American companies are available, but it is thought that the domestic production in 1916 was about equal to the former imports. Eastern users, however, are urging greater production.

There has been a striking increase in the production of cutlery and related articles. The old American preference for imported articles has kept alive in this country a thriving business in such articles. Barber shears, razors, butcher knives, cleavers, boning knives, and so on, are now supplied by American manufacturers in sufficient quantities to meet the demand. All these articles needed was a fair trial.

As a result of restriction placed upon the shipments of asbestos from Canada, which is the world's chief source of supply, we are now paying attention to our own deposits. In 1915 there was a great increase in the production of high-grade asbestos in Arizona. The lower-grade asbestos produced in this country comes mainly from Georgia. Deposits are now reported from the Caspar Mountain and other regions in Wyoming. The Geological Survey is of the opinion that the present output can be greatly increased.

The list could be greatly extended, but the foregoing should be sufficient to prove the point that when Americans are forced by necessity they can manufacture practically any line of goods. We have it in us to make ourselves industrially independent of all other nations in case of necessity, and we are rapidly making progress in that direction.

From the evidence in the case, therefore, it appears that it is possible to make preparations that will save us from disaster in foreign trade when our old competitors reenter the field. We haven't made all the necessary preparations at this writing, but we are doing well and there is a great deal of vitality in the movement now where at first there was only talk. And we are proving that we never again will have to depend upon others for important products. "Preparedness" has a real and vital meaning for Americans to-day.

THE WOOLWORTH BUILDING

The Tallest Commercial Structure Ever Erected. Home of the "Scientific American."

CHAPTER XXI.

EDUCATION

FROM DATA FURNISHED BY THE U. S. BUREAU OF EDUCATION

I. SUMMARY OF STATISTICS

THERE are nearly 22,500,000 enrolled in educational institutions in the United States. Of these, 19,500,000 are in elementary schools; 1,450,000 in secondary schools, both public and private, and 216,000 in colleges and universities. Close to a hundred thousand are in normal schools preparing to be teachers; 67,000 are in law, medical and other professional schools, and the remaining million or more are in various types of educational institutions. There are 706,000 teachers, of whom 580,000 are in public schools. Annual expenditures for education aggregate $800,000,000.

The following table summarizes the latest school and college enrollment figures.*

SCHOOL AND COLLEGE ENROLLMENT IN THE UNITED STATES

	Public	Private	Total
Elementary (kindergarten, primary and grammar)	17,934,982	1,626,310	19,561,292
Secondary (high schools and academies)	1,218,804	154,857	1,373,661
Secondary (preparatory departments of higher institutions)	22,414	63,324	85,738
Universities and colleges	87,820	128,673	216,493
Professional schools	12,289	54,777	67,066
Normal schools	89,537	5,749	95,286
Total for the above	19,365,846	2,033,690	21,399,536
City evening schools	610,966	.....	610,966
Business schools	.....	168,063	168,063
Reform schools	54,798	.....	54,798
Schools for the deaf	13,370	489	13,859
Schools for the blind	4,971	.....	4,971
Schools for the feeble-minded	15,253	687	15,940
Government Indian schools	32,718	.....	32,718
Schools in Alaska supported by the Government	3,666	.....	3,666
Other public schools in Alaska	3,100	.....	3,100
Orphan asylums and other benevolent institutions (estimated)	.....	20,000	20,000
Private kindergartens (individually reported)	.....	74,725	74,725
Miscellaneous (art, music, etc.) (estimated)	.....	60,000	60,000
Total for special schools	738,842	323,964	1,062,806
Total for all schools in the United States	20,104,688	2,357,654	22,462,342

*From Annual Report of the U. S. Commissioner of Education, 1916.

PUBLIC EDUCATION IN THE UNITED STATES—PROGRESS SINCE 1877

	1877	1913		1877	1913
Total population estimated	46,112,700	97,163,330	HIGH SCHOOLS		
School population 5 to 18 estimated	14,025,800	25,449,928	Institutions	1,340	13,445
PUBLIC SCHOOLS (INCLUDING HIGH SCHOOLS)			Teachers	6,759	67,092
Enrollment of pupils	8,965,006	18,523,558	Students	98,485	1,283,009
Average daily attendance	5,426,595	13,510,643	NORMAL SCHOOLS		
TEACHERS			Institutions	152	284
Male	114,312	113,342	Teachers	1,189	4,897
Female	152,738	451,118	Students	27,765	94,455
Total	267,050	564,460	UNIVERSITIES AND COLLEGES		
Value of school property	$198,554,584	$1,345,116,371	Institutions	433	596
Expenditure for instruction	$54,973,776	$303,537,949	Professors and instructors	4,865	19,858
Total expenditure	$79,439,826	$534,058,580	Students	66,737	202,231
AVERAGE NUMBER OF DAYS			SCHOOLS OF MEDICINE, LAW AND THEOLOGY		
In school year	133.4	158.0	Institutions	249	411
			Professors and instructors	1,799	10,019
			Students	16,422	49,081

PROGRESS IN EDUCATION, FROM A CHART OF THE U. S. BUREAU OF EDUCATION EXHIBIT, PANAMA-PACIFIC INTERNATIONAL EXPOSITION, 1915

II. ORGANIZATION OF EDUCATION IN THE UNITED STATES

Education in the United States has developed as a State rather than a national matter. All the States provide elementary education, ranging from seven to nine years, and secondary education of one or more years, and in practically every State higher educational opportunities are available without cost for tuition to both sexes. Recently provision has been made in some States for adequate vocational, commercial and professional education at public expense, but only a small number of States have as yet created State systems of vocational education. Support of schools is from State and local sources, the proportion ranging from Massachusetts, where 96.8 per cent of the funds come from local taxation, to Alabama, where only 24 per cent of the funds for school purposes come from local taxation and 69.4 per cent from the State. The Federal Government early in its history made important grants of land for general educational purposes; it gives financial aid to agricultural and mechanical colleges and experiment stations in all States, and has recently begun to support extension education for agriculture and home making. It has also maintained, since 1867, a Federal Bureau of Education which serves as a clearing house of information on education for the benefit of all the States. Control of public schools, originally centered in the local community, has lately become transferred in large measure to the county and to the State, as State aid and responsibility for education have broadened. Conditions still vary, however, from almost complete State domination in a few States to nearly complete local autonomy in others. The National Government exerts no control over education in the States other than that involved in the administration of certain land grant funds and appropriations for extension education. The function of the Federal

Bureau of Education is advisory rather than administrative.

III. COMPULSORY EDUCATION

Education is compulsory, to a greater or less degree, in all the States except one—Mississippi. Massachusetts adopted a compulsory education law in 1852. Vermont followed in 1867; Michigan, New Hampshire and Washington in 1871; Connecticut and New Mexico in 1872; Nevada in 1873; California, Kansas, New York, New Jersey, Maine, Ohio, Wyoming and Wisconsin between 1874 and 1880. The more recent adoptions have been in the Southern States: Alabama, Florida, South Carolina and Texas in 1915 and Georgia in 1916. The laws vary widely in scope and effectiveness. In some States they are operative only after acceptance by counties and local communities; in others they are effective for only part of the territory of the State, large areas being exempted. The upper age limit for compulsory attendance ranges from age 12 in Georgia, Kentucky, North Carolina and Virginia, to age 16 in sixteen of the States, and 18, under certain conditions, in one (Idaho). The more usual compulsory period is 8 to 14 years of age, or "until completion of the eighth grade." The minimum attendance in any one year varies from twelve weeks in Nebraska and Virginia to the "full school year" in twenty-nine States. Compulsory education laws have usually been fortified by State child labor acts and more recently (1916) by a Federal child labor law.

IV. ILLITERACY

Illiteracy in the United States is 7.7 per cent as compared with 1 per cent in Great Britain, 4.3 per cent in France and 0.05 per cent in Germany. According to the census of 1910 there were five and a half million illiterates in the United States over 10 years of age. This is over a million more than the combined total population of Montana, Idaho, Wyoming, Colorado, New Mexico, Arizona, Utah, Nevada and California (4,447,507); or of Maine, New Hampshire, Vermont, Massachusetts and Rhode Island (5,438,945); or of South Carolina, Georgia and Florida (4,877,140). A State made up of these illiterates would be nearly as large as Illinois (5,638,591). There were more illiterates in 1910 than comprised the entire population of the United States in 1800 (5,403,383), or the equivalent of the entire combined metropolitan population of Philadelphia, St. Louis, Boston, Cleveland, Baltimore, Pittsburgh, Detroit, and Buffalo. The percentage of illiteracy in the United States was lowered between 1890 and 1910 from 13.3 per cent in 1890 to 10.7 per cent in 1900, and 7.7 per cent in 1910; but the number of illiterates decreased less than 15 per cent and the number of foreign born illiterates increased 43 per cent. More than two-thirds of all illiterates are country-dwellers; the rural illiteracy (10.1 per cent) is nearly twice that in the cities (5.1 per cent). Existing illiteracy is therefore ascribed to foreign immigration and lack of school facilities in country districts. The State and national governments are aiding city evening schools to eliminate illiteracy among the foreign born, and several States—Kentucky, Alabama, North Carolina—have created State illiteracy commissions to deal with the problem in rural communities.

V. TYPES OF SCHOOLS

Elementary. — Elementary education in the United States has become almost exclusively a public function. Of the 1,626,310 pupils reported in private elementary schools, 1,429,859 are in parish schools of the Catholic Church. Private kindergartens and special schools account for a large part of the remaining number.

Secondary.—The high school is the most typical American educational institution. There are 11,674 public high schools, of which 8,440

have four-year courses. Secondary education has become more and more a public function; 89 per cent of the secondary students are in public high schools. It is estimated by the United States Bureau of Education that 25 out of every 100 children who enter school reach the high school, and that 10 out of every 100 graduate from high school. The most important recent change in secondary education is the gradual introduction of the so-called "six-and-six" plan of organization, whereby six years are assigned to elementary education and six to secondary, the latter period being divided into "junior" and "senior" high schools of three years each. A hundred and fifty cities had taken steps toward adopting this form of organization in 1915.

Higher Education.—Of the 563 colleges and universities listed by the United States Bureau of Education, 95 are public institutions and 468 under private control; 327 are controlled by religious denominations; 140 are for men only; 83 for women only; and 340 are coeducational. There are 152,307 men students and 84,861 women students.* The number of men students has tripled and the number of women students has more than quadrupled since 1890.

The following table shows the distribution of school enrollment in the elementary and higher grades:

DISTRIBUTION OF SCHOOL ENROLLMENT ACCORDING TO ESTIMATED PERCENTAGES

Grades	Estimated per cent.	Estimated enrollment in grades
First grade	23.50	4,596,904
Second grade	14.79	2,893,115
Third grade	13.91	2,720,976
Fourth grade	13.28	2,597,739
Fifth grade	11.28	2,206,514
Sixth grade	9.25	1,809,419
Seventh grade	7.63	1,492,527
Eighth grade	6.36	1,244,098
Total elementary	100.00	19,561,292
First year high school	40.14	585,803
Second year high school	26.75	390,389
Third year high school	18.84	274,951
Fourth year high school	14.27	208,256
Total high school	100.00	1,459,399
Higher institutions	.....	378,845
Grand total	.....	21,399,536

*These are later figures than appear in the general summary at the beginning of this chapter.

VI. TEACHERS

Of the 706,152 teachers employed in the United States, 169,029 are men and 537,123 women. The number of teachers nearly doubled in the thirty years between 1885 and 1915. Nearly five-sixths of the teachers in public elementary schools are women, and of the 57,909 public high school teachers, 32,862 are women. The colleges and universities have 5,293 women instructors and 19,447 men. The following table summar-

izes the number of teachers in various types of schools.

VII. VOCATIONAL EDUCATION

Six States—Massachusetts, New Jersey, New York, Pennsylvania, Indiana and Wisconsin—have regularly established systems of vocational or industrial education. Two others

TEACHERS IN THE UNITED STATES

Teachers in—	Men	Women	Total
Public elementary schools	89,615	432,534	522,149
Public high schools	25,047	32,862	57,909
Private elementary schools (estimated)	8,060	39,354	47,414
Private high schools	5,820	8,070	13,890
Universities and colleges:			
Preparatory departments	2,484	1,493	3,977
Collegiate departments	16,963	3,800	20,763
Professional schools:			
Theology	1,516	.....	1,516
Law	1,471	.....	1,471
Medicine	6,955	.....	6,955
Dentistry	1,532	.....	1,532
Pharmacy	744	.....	744
Veterinary medicine	364	.....	364
Normal schools, public:			
Normal department	1,636	2,904	4,540
Other departments	605	981	1,586
Normal schools, private:			
Normal department	136	223	359
Other departments	132	131	263
Commercial and business schools	2,019	1,731	3,750
Schools for defectives and delinquents	1,175	2,728	3,903
Indian and Alaskan schools	1,255	1,638	2,893
Kindergartens and miscellaneous (estimated)	1,500	8,674	10,174
Total	169,029	537,123	706,152

—California and Connecticut—maintain State-aided vocational schools, and some form of vocational or industrial education is provided by eight other States, while in the States which do not provide State aid for vocational education separate municipalities have established several types of vocational education at public expense. The need for industrial training for the youth of the nation has been urged by organizations of business men, labor-union workers, and schoolmen within the past few years as a measure of national conservation and preparedness. European nations—especially Germany—have been ahead of the United States in this regard. It has been pointed out that prior to the outbreak of the European war more trade workers were being trained at public expense in the city of Munich than in all the larger cities of the United States combined.

VIII. COST OF EDUCATION

The estimated cost of education in the United States for 1914, the latest year for which statistics are available, was $794,459,968. The table over leaf shows the distribution of this expenditure and the per capita cost for different types of schools.

IX. GIFTS AND BEQUESTS TO EDUCATION

In the forty-four years, 1871 to 1914, private philanthropy added $584,418,082 to the available funds of colleges and other educational institutions in the United States. The bulk of these funds goes to colleges and universities. Of the $31,357,398 given in 1914, $26,670,017 was for universities and colleges, $1,558,281 for schools of theology, $203,067 for

SCHOOL ENROLLMENT AND ESTIMATED COST

Classification	Enrollment, 1914	Estimated per capita cost	Estimated total cost
Public elementary schools	17,934,982	$27.11	$486,165,968
Public high schools	1,218,804	56.54	68,911,178
Private elementary schools	1,626,310	32.00	52,041,920
Private high schools	154,857	94.10	14,572,044
Other public and private secondary schools	85,738	157.47	13,501,163
Universities, colleges and professional schools	283,559	335.57	95,153,894
Normal schools	95,286	158.34	15,087,585
Commercial and business schools	168,063	50.00	8,403,150
Reform schools	54,798	157.92	8,653,700
Schools for the deaf	13,859	300.80	4,168,787
Schools for the blind	4,971	498.34	2,477,248
Schools for the feeble-minded	15,940	555.42	8,753,495
Government Indian schools	32,718	116.69	3,817,863
Schools in Alaska supported by the Federal Government	3,666	56.13	205,773
Other public schools in Alaska	3,100	50.00	155,000
Orphan asylums, etc	20,000	200.00	4,000,000
Private kindergartens	74,725	32.00	2,391,200
Miscellaneous—music, art, etc	60,000	100.00	6,000,000
Total	21,851,376	$36.36	$794,459,968

law schools, $1,495,773 for medical schools, $607,431 for public normal schools, $116,283 for private normal schools, and $706,546 for private secondary schools. The following table shows the annual amount of gifts and bequests to education since 1894:

GIFTS AND BEQUESTS TO EDUCATION, 1894-1914

1894	$10,855,365
1895	8,240,876
1896	11,677,048
1897	10,049,141
1898	10,981,209
1899	25,332,792
1900	15,066,561
1901	21,158,400
1902	20,348,739
1903	17,915,075
1904	17,261,375
1905	21,827,875
1906	23,347,070
1907	28,585,780
1908	19,763,421
1909	21,192,450
1910	24,755,663
1911	27,634,029
1912	30,061,310
1913	29,651,879
1914	31,357,398

X. LIBRARIES

There were over 18,000 regularly established libraries in the United States in 1913, containing more than 75,000,000 volumes. The number of volumes is an increase of 20,000,000 since 1908.

READING ROOM, CONGRESSIONAL LIBRARY

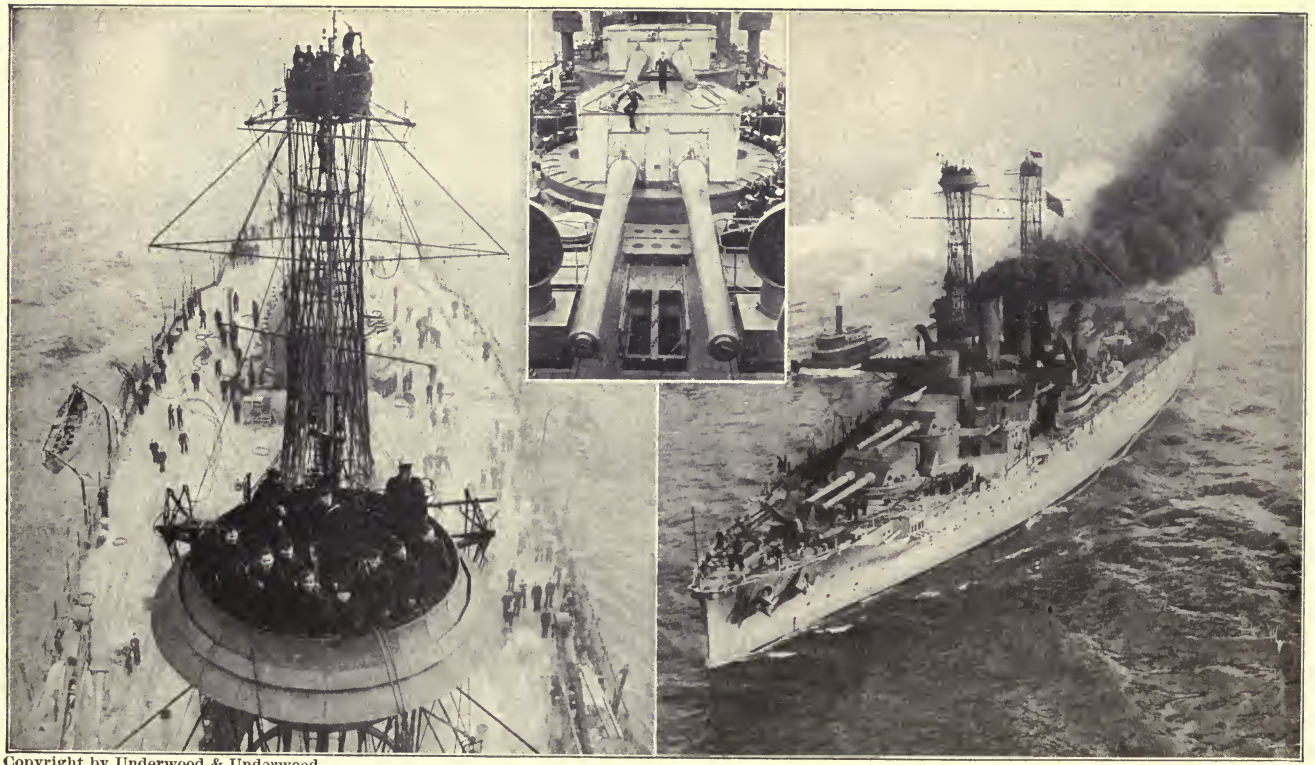
Of the 2,849 libraries containing 5,000 volumes or over, 1,844 are classified as "public and society libraries," and 1,005 are school and college libraries. Public and society libraries have an aggregate of over fifty million volumes, with seven million borrowers' cards in force; 1,446 of these libraries were entirely free to the public.

Libraries reporting from 1,000 to 5,000 volumes numbered 5,453, of which 2,188 were public and society libraries, and 3,265 school libraries. These libraries contained 11,689,942 volumes. Another group of libraries, comprising those that reported from 300 to 1,000 volumes, increased the total by 2,961,007 volumes.

Of the 1,844 public and society libraries with over 5,000 volumes reported for the entire United States, more than half were in the North Atlantic States, and they contained 24,627,921 volumes out of the total of fifty millions; and of the three million volumes added to library collections for the year 1913, almost one-half were for the same section. New York State had 7,842,621 volumes in her 213 libraries; Massachusetts, 7,380,024 in 288 libraries; Pennsylvania, 3,728,070; and Illinois, 3,168,765 volumes. Four-fifths of the borrowers' cards in use were in the North Atlantic and North Central States.

Photo Harris & Ewing

ENTRANCE HALL, LIBRARY OF CONGRESS



Fire Control Platforms of the "New York" Guns of the "Wyoming" The "Arkansas"

UNCLE SAM'S DREADNOUGHTS

CHAPTER XXII.

THE NEW NAVY

THE NAVAL PROGRAMME OF 1916.

ON August 29, 1916, President Wilson signed the Naval Appropriation Bill, authorizing a three-year building programme, of greater size and importance than this nation has ever previously contemplated. To get a perspective on this bill and what it means, consider

INCREASE OF NAVY SINCE 1903

YEAR	Appropriation	Amount for increase navy	Building programme
1906.....	$102,091,670.27	$33,475,829.00	1 first-class battleship 3 torpedo-boat destroyers 8 submarines
1907.....	98,958,507.50	23,713,915.00	1 first-class battleship 2 torpedo-boat destroyers
1908.....	122,663,885.47	30,307,962.00	2 first-class battleships 5 colliers 10 torpedo-boat destroyers 8 submarines
1909.....	136,935,199.05	38,819,595.00	2 first-class battleships 1 collier 8 destroyers (3 sub-surface) 4 submarines
1910.....	131,350,854.38	33,770,346.00	2 first-class battleships 2 colliers 6 torpedo-boat destroyers 4 submarines
1911.....	126,478,338.24	26,005,547.67	2 first-class battleships 2 colliers 1 river gunboat 1 gunboat 2 tugs 4 submarines 1 submarine tender 8 torpedo-boat destroyers
1912.....	123,225,007.76	20,569,373.48	1 battleship, first line 2 fuel ships 6 destroyers 1 destroyer tender 8 submarines 1 submarine tender
1913.....	140,800,643.52	35,325,695.00	1 battleship 1 transport 1 supply ship 6 destroyers 4 submarines
1914.....	144,868,716.61	41,091,734.00	3 battleships 6 destroyers 8 (or more) submarines
1915.....	149,661,864.88	46,853,801.00	2 battleships 6 destroyers 2 seagoing submarines 16 coast-defense submarines 1 oil fuel ship

the figures on the preceding page showing the increase during the past years.

With these figures in mind consider the present bill, which in addition to provision for enlarged personnel and material authorizes ten battleships, six battle cruisers, ten scout cruisers, fifty destroyers, nine fleet submarines, fifty-eight coast submarines, three fuel ships, one repair ship, one transport, one hospital ship, two destroyer tenders, one submarine tender, two ammunition ships and two gunboats. As soon as is practicable, which means in the very near future, four battleships, four scout cruisers, four battle cruisers, twenty destroyers, thirty coast submarines, one fuel ship, one hospital ship, one ammunition ship and one gunboat are to be begun—indeed, the bill makes it mandatory to contract for or begin construction on these within six months.

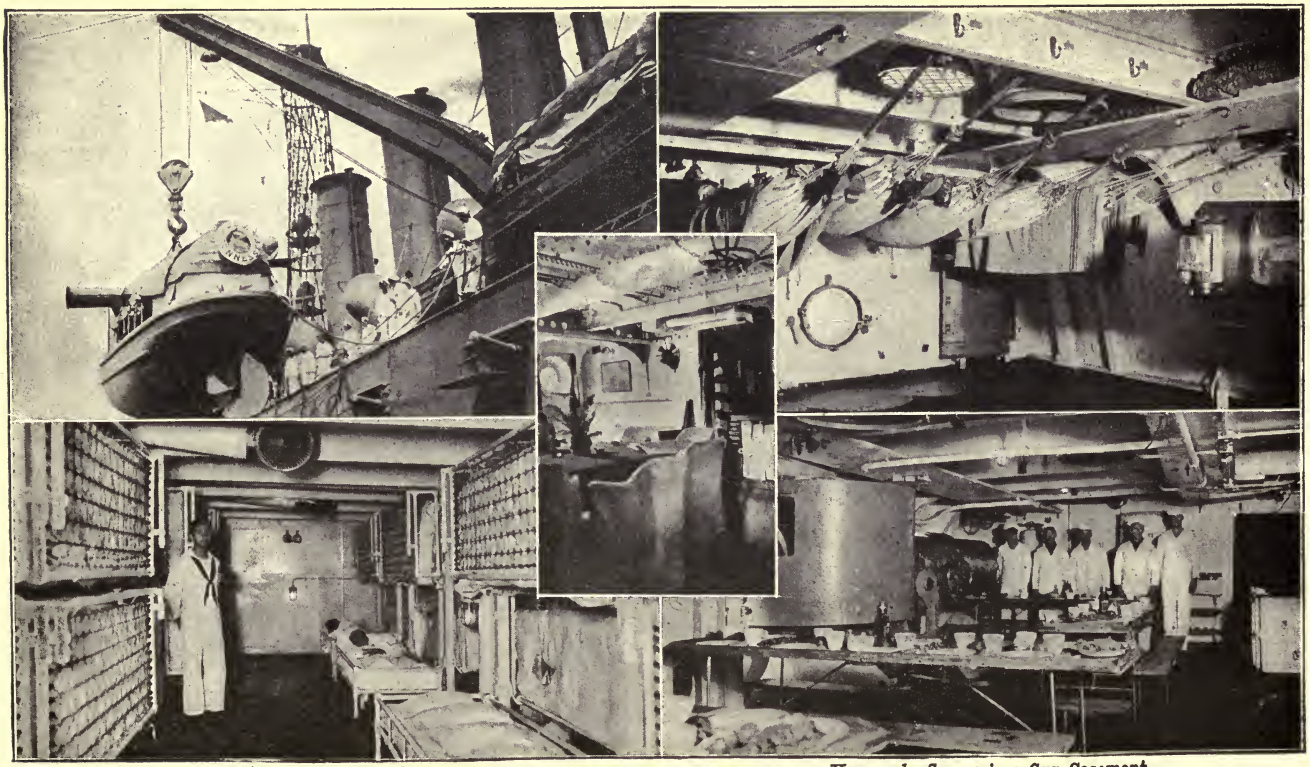
For months the technical bureaus of the Navy Department have been working on the designs of the vessels. In these designs they have incorporated military characteristics which are the result of the lessons learned from naval operations in the war and their application to the requirements of the Navy. The department advertised for bids for the construction of four battleships, four scout cruisers, twenty destroyers and thirty submarines of two distinct types the day the bill was affirmed and at the same time directed the navy yards at Philadelphia, Boston and Charleston to proceed with the construction of the hospital ship, the fuel ship and the gunboat, respectively.

The battleships, known for the present as Nos. 45 to 48, inclusive, will be slightly larger than their predecessors, the "Tennessee" and "California." Their chief characteristics are: Displacement, 32,600 tons; speed, 21 knots; battery, eight 16-inch guns, eighteen 5-inch guns, four 3-inch anti-aircraft guns; complement, 1,022. They will have the large cruising radius which characterizes all recent United States battleships. Their armor and underwater protection will be unusually complete.

The scout cruisers, known as Nos. 4 to 7, inclusive, will be the largest and fastest vessels of this class ever laid down for any navy. The chief characteristics are: Displacement, 7,100 tons; speed, 35 knots; length, 550 feet; beam, 55 feet; armament, eight 6-inch guns, four torpedo tubes and two 3-inch anti-aircraft guns; complement, 330. Their high-powered machinery installations will be protected by light but efficient vertical and horizontal armor. A new feature never before incorporated in any ship of a powerful military type will be the equipment for carrying, launching and operating four of the largest size hydro-aeroplanes.

The torpedo boat destroyers, known as destroyers Nos. 75 to 94, inclusive, will carry a heavy battery and will have an unusually large cruising radius. They represent a small increase in displacement over the last class laid down, but will deliver an increased speed of about five knots. Their chief characteristics will be: Displacement, 1,185 tons; speed, 35 knots; battery, four 4-inch guns, four triple torpedo tubes, two anti-aircraft guns; complement, 95. They will attain their rated speed on full designed displacement, and not on a very much lesser displacement, which can only be attained by the stripping of many essentials, as in a number of foreign boats of this class, for which very high speeds are claimed.

Of the coast defense submarines, twenty-seven will be of the usual type known as Nos. 78 to 104, inclusive. The remaining three, Nos. 105, 106 and 107, will be a new type representing a marked increase in size over the usual coast-defense submarine and a decrease in size from the very large fleet submarine. Each of these three vessels will represent different ideas in their detailed designs, and the Navy hopes, in their development, to arrive at a



Hoisting a Launch Aboard
Sick Bay of the "Florida"

Commander's Quarters

Hammocks Swung in a Gun Casement
Galley of a Battleship

ROMANCE AND REALISM OF A SAILOR'S LIFE

size of vessel which will be sufficiently large to perform nearly all the duties required of a submarine, but at the same time will be sufficiently small to enable it to be built quickly in large numbers.

The hospital ship will be the first built especially for this purpose for the Navy, those now in use being converted merchant vessels. The design has been worked out by the technical bureaus of the department in constant consultation with the Bureau of Medicine and Surgery, with the result that it will embody every feature of the most up-to-date hospital on shore. It will have accommodations for 500 patients. Its chief characteristics and dimensions are: Displacement, 9,800 tons; length, 460 feet; breadth, 60 feet 10⅛ inches; draft, 19 feet 6 inches; speed, 16 knots. As this vessel will be, under the terms of the Geneva Convention, immune from capture or attack in time of war, it will not, in accordance with the terms of that convention, carry an armament of any kind for offense or defense, and its design includes no military features of any sort.

The fuel ship, known as fuel ship No. 16, will be a large oil tanker, of ordinary commercial type, except that its design will meet the requirements for a vessel which must accompany the battle fleet and be prepared to supply fuel oil to vessels of all sizes under adverse conditions of wind and sea. Its chief dimensions and characteristics are: Displacement, 14,500 tons; length, 455 feet; beam, 56 feet; draft, 26 feet 4 inches (about); total dead weight carrying capacity, 9,600 tons; speed, 14 knots.

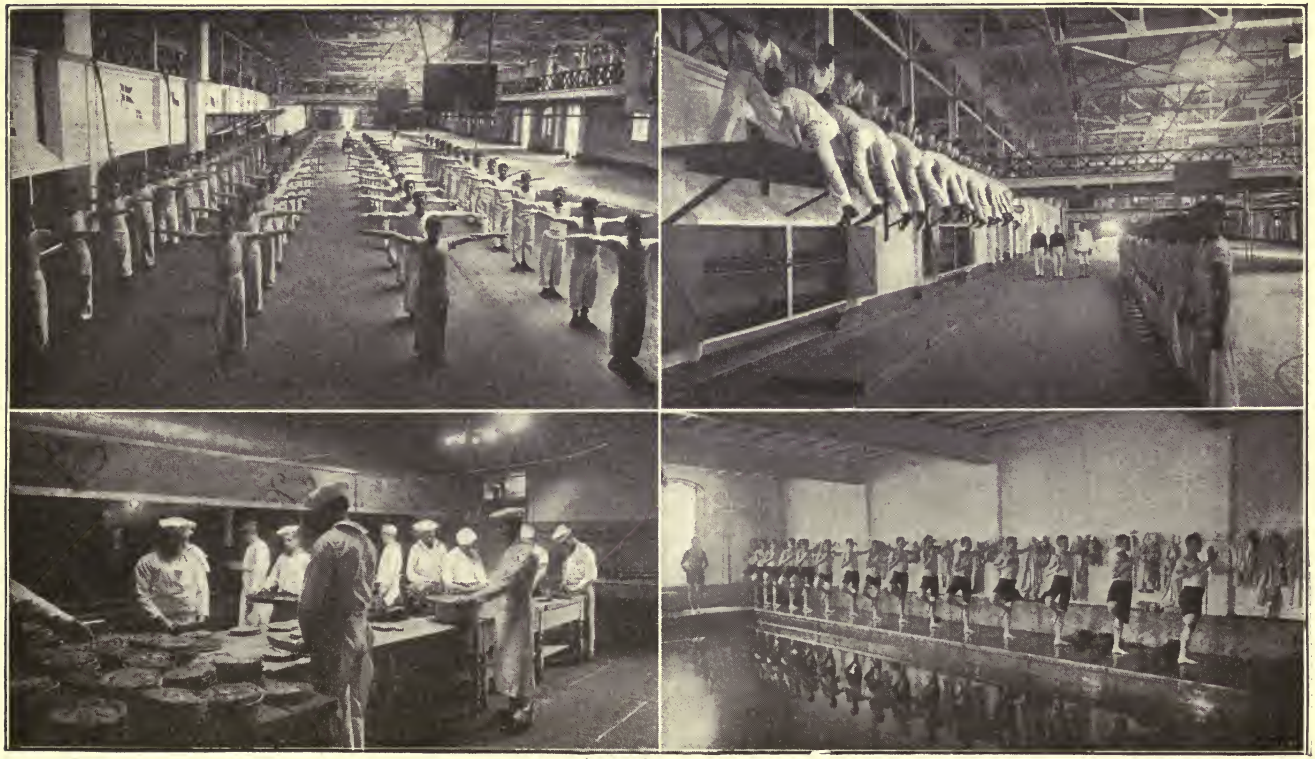
The gunboat, known as gunboat No. 21, will be a vessel designed especially for long-continued service in tropical waters. Its chief characteristics will be: Displacement, 1,575 tons; length, 241 feet 2 inches; breadth, 41 feet 2½ inches; draft, 11 feet 4 inches; armament, three 4-inch guns, two 1-pounder guns, four 30-caliber machine guns, two 3-inch field guns, two 3-pounder guns; speed, 12 knots; complement, 149.

The only designs of the current programme not yet completed are those for the battle cruiser and the ammunition ship. Plans and specifications for the battle cruisers will be completed and issued to bidders about October 1, 1916, and for the ammunition ship November 1, 1916. This will permit contracts to be placed in advance of the termination of the six months period named in the Appropriation Bill.

VESSELS IN THE NAVY

According to the official reports there were upon the Navy list 399 vessels June 30, 1915, listed as follows: Battleships, 41; submarines, 57; fuel ships, 24; tugs, 48; yachts, 16; cruisers, 24; gunboats, 31; destroyers, 69; torpedo boats, 20; transports, 6; tenders, 9; monitors, 9; special types, 8; supply ships, 5; hospital ships, 2; armored cruisers, 10, and ships of all kinds in an unserviceable condition, 20. In addition to this list of ships there are authorized by the Naval Act of

SUBMARINE "D-1"



Gymnasium Drills

Jack Tar Loves Pies

The Swimming Pool

SAILORS IN TRAINING AT NEWPORT, R. I.

March 3, 1915, battleships Nos. 43 and 44, destroyers Nos. 69 to 84, inclusive, and submarines Nos. 60 to 77, inclusive. Appropriations for the beginning of the construction of these vessels were made available July 1, 1915.

It is expected that on July 1, 1917, there will be in active commission the following vessels:

Battleships	22
Armored cruisers	5
Cruisers	12
Destroyers	52
Gunboats	26
Submarines	56
Destroyer tenders	4
Submarine tenders	6
Transports	2
Repair ships	2
Fleet tugs	6
Hospital ship	1
Fleet colliers (manned by naval crews)	4
Mining ships	2
Supply ships	3
Ammunition ship	1

And in reserve with 40 per cent complements:

Battleships over 15 years old	17
Armored cruisers	5
Cruisers	11
Destroyers	16
Old torpedo boats	19
Destroyer tender ("Dixie," 194)	1
Submarine tender ("Iris," 86)	1
Supply ship (100)	1
Transport (100)	1

NAVY OF THE FUTURE

In its 1915 departmental report the Navy Department lists those ships of the present fleet, afloat and building, which will be serviceable in 1922. To this list must now be added the authorized ships in the most recent Navy bill, in order to gain an idea of what our present and projected Navy will amount to when the present stupendous programme is completed. Of course, the present plans are to complete the programme prior to 1922, and unquestionably further additions will be made to the Navy in future Congresses, but the following list, which is compiled from the Navy Department figures plus those of the new bill, should indicate the approximate strength of the Navy in usable, fightable ships at a date of approximately 1920 to 1922, as far as present knowledge can project it:

SHIPS OF THE FLEET SERVICEABLE IN 1920-1922

Dreadnoughts, first line	27
Pre-dreadnoughts, second line	13
Superannuated pre-dreadnoughts, third line	9
Battle cruisers	6
Scouts	31
Destroyers	108
Fleet submarines	12
Coast submarines	120
Fuel ships	16
Repair ships	3
Supply ships	4
Transports	5
Hospital ships	2
Mine ships	3
Destroyer tenders	4
Fleet submarine tenders	2
Ammunition ships	2
Harbor defense monitors	6
Harbor defense battleships	3
Gunboats	26

NAVY YARDS, STATIONS, POSSESSIONS

To the average man the Navy consists of the vessels which float in the water and such property as may be upon them. To the naval man, however, the property ashore necessary to maintain the ships at sea is every whit as important as the vessels themselves, and, as will be seen in a moment, is no inconspicuous part of the expenditures necessary to make or maintain the Navy.

The United States possesses eleven navy yards in the United States, located at Portsmouth, Boston, New York, Philadelphia, Washington, Norfolk, Mare Island, Puget Sound, Charleston, Pensacola and New Orleans. Across the water it has navy yards in Hawaii, Cavite and Olongapo. It possesses naval stations at Port Royal and Key West, and abroad at Guantanamo, San Juan, Guam and Tutuila. It possesses training stations at Newport, San Francisco and the Great Lakes; coaling stations at Frenchman's Bay and Melville, and in addition has property at Sitka, Alaska; New London, Conn.; Yokohama, Japan; the Naval Academy at Annapolis, the naval proving ground at Indian Head, a naval hospital at Las

Animas, a naval base at Culebra and a torpedo station at Newport, R. 1. The investment in these naval establishments totals $196,059,926 since the beginning of the modern idea of the Navy in 1800, when the Portsmouth, Boston, Washington and Norfolk navy yards were first established.

COST OF NAVY

The total cost of all the ships upon the Navy list to the date mentioned, and excluding the new work authorized in the Naval Act of March 3, 1915, or the ships authorized in the tremendous 1916 bill, is $459,686,551.32.

It must not, however, be supposed that adding together the cost of battleships and the cost of naval establishments gives any idea of the cost of the entire Navy since it was first begun. The total expenditures for the Navy from 1794 to 1915, inclusive, totals the unthinkable sum of $3,214,339,051.10. This, of course, includes ships, establishments, pay, materials and all expenses in connection with the Navy Department.

HOW NAVY APPROPRIATIONS ARE SPENT

The Bureau of Supplies and Accounts of the United States Navy requires a closely printed statistical report of 294 pages to summarize the financial operations of the Navy. Nothing, therefore, but the most comprehensive and inclusive statistics can be given in the short space here available. The table on the next page will be found interesting as showing the principal items of expenditures in connection with the Navy.

New expenditures authorized for the Navy include $11,000,000 for an armor plant and $1,500,000 for an experimental and testing laboratory.

ENLISTED PERSONNEL

Having a certain number of fighting ships and the required naval

BLUEJACKETS, NAVAL TRAINING STATION, NEWPORT, R. I.

PRINCIPAL ITEMS

Amount appropriated by Congress for the fiscal year 1915	$145,616,241.96
Total expenditures during 1915	142,959,092.11
Expenditures for maintaining ships in commission:	
Operation	$46,890,893.90
Repairs to ships	4,931,279.89
Changes	3,071,837.55
Repairs to equipage	430,757.34
Total	$55,324,768.68
Expenditures for construction of vessels:	
Battleships	$20,029,890.37
Gunboats and fuel ships	1,913,950.53
Destroyers	5,475,285.52
Submarines	3,636,416.46
Tenders and tugs	935,121.34
Total (at navy yards, $4,540,152.65; under contract, $27,450,511.57)	$31,990,664.22
Expenditures for pay and allowances of officers and men:	
Navy	$41,185,445.10
Marine Corps	3,920,563.99
Total	$45,106,009.09
Cost of subsisting the enlisted men of the Navy and Marines afloat	$5,897,181.54
Average cost of subsisting one man for one day	.36
Cost of maintenance of navy yards	16,275,490.63
Cost of all work done at industrial yards:	
Labor	$17,843,767.56
Material	14,958,449.00
Indirect expense	4,277,083.91
Total	$37,079,300.47
Value of materials received into store (including ordnance material)	$112,118,294.44
Value of materials issued from store (including ordnance material	105,482,564.30
Property investment of naval establishment:	
Ships	$459,686,551.32
Stations	206,635,104.59
Stores	192,070,228.67
Total	$858,391,884.58
Expenditures for naval militia	$905,226.07
Present value of clothing and small-stores fund:	
Stock	$3,587,075.04
Money	1,517,347.50
Total	$5,104,422.54

stations, bases and navy yards to keep them in condition, a navy would nevertheless be helpless were it not for its personnel, regarded by Navy men as equally important with material and equipment, and generally all too much disregarded by the appropriating power, unfortunately a non-technical body of men. Nevertheless, the last Congress, in its huge building programme, took cognizance of the fact that more men and officers were necessary and made appropriations and provision for this increase.

The total enlisted force in the United States Navy was, on June 30, 1915, 52,561 men, of which 47,505 were native born and 5,056 were foreign born. Of these, 48,908 were white, the balance being negro, Chinese, Japanese, Filipino, Samoan, Hawaiian, American Indian and Porto Rican. Fifteen States of the United States furnish 65 per cent of the enlisted force. New York fur-

LEARNING MECHANICS AND SEAMANSHIP AT NEWPORT, R. I.

nishes the largest number of native born American seamen in the American Navy, 6,719, and Alaska the smallest number with 6.

Contrary to the general opinion the United States Navy does not have difficulty in obtaining men for enlistment. Its trouble comes in the high standard which makes the majority of applications result in rejections. For instance, during the year 1915 there were 102,561 applications for enlistment. Of these only 17,704 were enlisted and 6,291 of this number were re-enlistments. Over 61,000 of the rejections were on account of disability and 17,000 for other causes.

In order to supply men qualified for certain ratings in the Navy, the following schools are maintained:

Electric schools at New York and Mare Island.

Machinists' school at Charleston, S. C.

Torpedo school at Newport, R. I.

Coppersmith school at Philadelphia.

Fuel oil school at Philadelphia.

Artificer school at Norfolk.

Yeoman schools at Newport and San Francisco.

Commissary schools at Newport and San Francisco.

Hospital attendant schools at Newport and San Francisco.

Musician schools at Norfolk and San Francisco.

Mess attendant school at Norfolk.

During the last fiscal year 2,278 men were pursuing courses at these various schools. Of these, 1,302 completed their course and were detailed to active duty.

A new class of enlisted men at the Pensacola Aviation School is formed every three months. Some of these men are taught and exercised in the principles of flight, and all are trained in the mechanics of aviation.

On January 1 a school for the

DISTRIBUTION OF ENLISTED MEN OCTOBER 1, 1915

Vessels afloat (including 305 insular force)		41,593
Four training stations, including those under instruction, instructors and necessary details	4,494	
Fifteen trade schools, including those under instruction, instructors and necessary details	1,376	
Total		5,870
Sixteen hospitals:		
Hospital attendants	398	
Patients	1,179	
Total		1,577
Recruiting stations:		
Thirty-five main stations; eighty-three substations		407
Radio stations		316
Aeronautic station		134
Vessels under construction		283
Shore duty at navy yard, naval stations and special duty:		
Special duty		120
Seamen branch, yeomen, artificers, hospital corps, messmen and bandsmen	760	
Insular force	153	
Total		913
Not available:		
Insane asylums	18	
Prisoners	1,105	
Traveling, leave, unavailable	300	
Total		1,423
Grand total		52,636
Insular force (included in above table):		
Cavite		178
Olongapo		177
Guam		38
Tutuila		65
Total		458

Making Bags for Smokeless Powder
Assembling Rapid Fire Shells

Putting Smokeless Powder in Bags
Preparing Smokeless Powder Charges

MAKING AMMUNITION

care and handling of gasoline engines was added to the School for Machinists' Mates at Charleston. It embraces a three months' course, in which the men learn to handle motor boats and vessels which use this type of small engine.

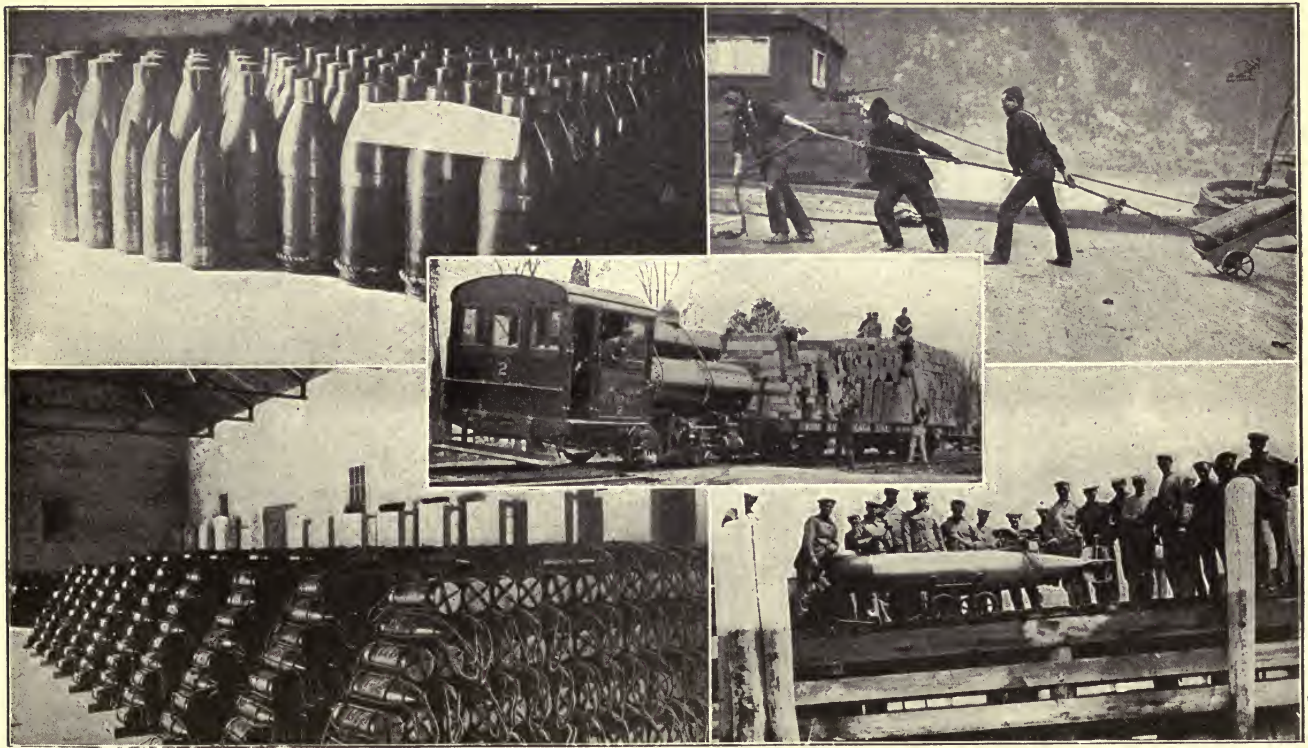
The radio courses at the Electric Schools at New York and Mare Island have been extended to include, besides the Continental Morse Code, the American Morse Code, so that all the men who qualify at these schools may be competent to talk to any commercial shore stations as well as the naval stations.

DESERTIONS

One of the troubles of all navies is found in the practice of desertion. Many men cannot stand discipline, others become dissatisfied for one reason or another, and, failing to understand the seriousness of the offense or being willing to take the chance of punishment if detected, absent themselves from the Navy without permission and thus become deserters. Two thousand three hundred and twenty men thus deserted during 1915, a decrease of several hundred under 1914 and a still larger decrease from 1913 and 1912, the figures for which are respectively 3,237 and 3,055. Of the 1915 deserters, 480 voluntarily returned to service, and 413 absentees were apprehended and delivered.

In 1907 a finger print identification system was installed in the identification office which now contains the finger prints of 133,214 men, including, of course, all those who have enlisted in the Navy since the establishment of this system. The result of the finger print system is to prevent re-enlistment under assumed names of men who have deserted from the Army and Navy or Marine Corps or who have been discharged for various reasons which would prevent them from re-

LAYING THE KEEL OF A BATTLESHIP IS AN IMPRESSIVE CEREMONY



Loaded shells
Shells ready for shipment
Transporting naval shells in cases
Loading Ammunition
Torpedo gunners transporting a torpedo

SOME ACTIVITIES OF THE BUREAU OF ORDNANCE

entering the service under their own names.

OFFICERS

The officers of the Navy are of various classes, as follows: Line, Medical, Dental, Pay, Chaplains, Professors of Mathematics, Naval Constructors and assistants, Civil Engineers and assistants, Chief Warrant Officers and Warrant Officers. On June 30, 1915, there were, of all kinds, 3,803 officers in the service.

Their classification is shown in the appended table:

	June 30, 1915
Line	2,029
Medical	351
Dental	31
Pay	221
Chaplains	27
Professors of mathematics	17
Naval constructors and assistant naval constructors	77
Civil engineers and assistant civil engineers	40
Chief warrant officers	468
Warrant officers	542
Total	3,803

Sixty-nine per cent of the Line Officers, 55 per cent of the Warrant Officers, 41 per cent of the Medical Corps, 45 per cent of the Pay Corps, 30 per cent of the Dental Corps, 1 per cent of the Naval Constructors and 53 per cent of the Chaplains were doing sea duty during 1915. It is therefore obvious—what is seldom understood by the layman—that a large proportion of the available officers of the Navy must be engaged in shore duty—ranging all the way from Annapolis work to being in charge of a radio station, from assignment to a navy yard to that of the Naval Observatory—without which the Navy as a fighting organization would be like a movable body without a directing head.

According to the provisions of the new Navy Bill, commissioned officers (of the line) instead of being an arbitrary number will be based on a percentage of the number of enlisted men. The new law provides that there shall be line officers to the number of 4 per cent of the enlisted personnel. At the present time there are, in round numbers, 54,000 enlisted men. This number, however, is to be largely increased in the near future as fast as enlistments can be made. Sixty-eight thousand men are authorized, and 4 per cent of this number, or 2,720, is the number of line officers which will command the new Navy.

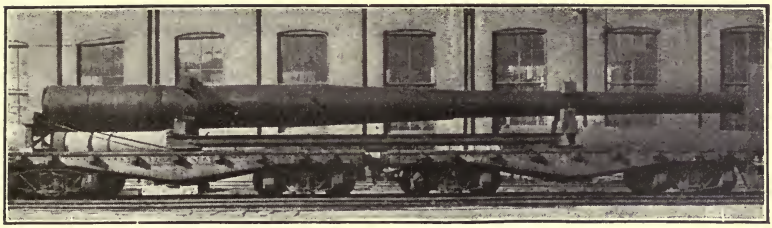
Inasmuch as the number of officers in each grade has also been placed upon a percentage basis, a great deal of changing and promotion is going on. At the present writing, 500 junior officers are taking examinations for promotions, and practically all who pass will be promoted. Congress, having increased the number of appointments to Annapolis, has provided for an increase of trained officers in the future. In a short time Annapolis, instead of training from 900 to 1,200 young men in the magnificent plant where the Navy makes officers, will be housing and teaching 1,500 or more at a time.

NAVAL CONSULTING BOARD

One of the most spectacular accomplishments of the present administration as far as the Navy is concerned is the organization of the Naval Consulting Board of Civilian Experts to advise with the Navy Department.

Some of the greatest improvements utilized by the Navy have come from civilian inventors and civilian engineers. It was a civilian who invented the "Monitor," built the first submarine, mastered the science of flight, perfected wireless communication, invented the gyroscope compass, electric steering gear, electric propulsion and silk floss life preservers.

The Secretary of the Navy, Mr. Josephus Daniels, invited Thomas A. Edison to help form this board. Mr. Edison's acceptance was hailed by the country as proof of a new era joining the powers of invention and the training of naval experts to apply new discoveries to the in-



A FOURTEEN INCH 50-CALIBER GUN

creased efficiency of the Navy. Members of eleven leading scientific societies were asked to choose two members each of the Naval Consulting Board. Its members have no status except the status of American citizens glad to respond to a call to put their talent, genius, learning and time at the service of their country. They even pay their expenses when on their governmental mission. As thus constituted, named by their own societies, without political or other suggestion, the board as originally constituted was composed of the most distinguished civilian experts, each one of whom in some department has won a high place in his profession.

The original composition of the committee was as follows:

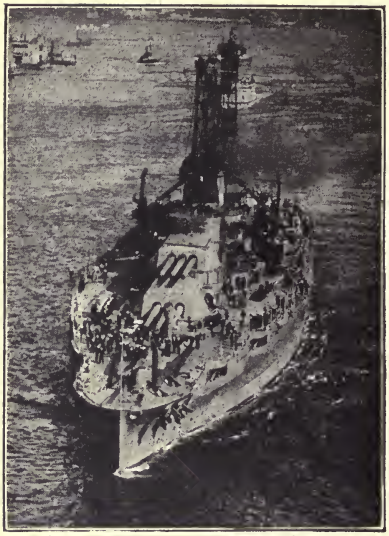
Thomas A. Edison, Chairman, and Miller Reese Hutchinson, Assistant to the Chairman.

American Chemical Society—W. R. Whitney and L. H. Baekeland.

American Institute of Electrical Engineers—Frank J. Sprague and B. G. Lamme.

American Mathematical Society—Robert S. Woodward and Arthur G. Webster.

THE NAVAL CONSULTING BOARD IN SESSION



Copyright International Film Service
THE SUPERDREADNOUGHT "PENNSYLVANIA"

American Society of Civil Engineers—Andrew M. Hunt and Alfred Craven.

American Aeronautical Society—Matthew B. Sellers and Hudson Maxim.

Inventors' Guild—Peter Cooper Hewitt and Thomas Robins.

American Society of Automobile Engineers—Howard E. Coffin and Andrew L. Riker.

American Institute of Mining Engineers (Metals)—William L. Saunders and Benjamin B. Thayer.

American Electro-Chemical Society—Joseph W. Richards and Lawrence Addicks.

The American Society of Mechanical Engineers—William Le Roy Emmet and Spencer Miller.

American Society of Aeronautic Engineers—Henry A. Wise Wood and Elmer A. Sperry.

They organized by the election of these officers: Chairman, Thomas A. Edison; First Vice-Chairman, Peter Cooper Hewitt; Second Vice-Chairman, William L. Saunders; Secretary, Thomas Robins; Assistant to the Chairman, M. R. Hutchison.

POWDER

The Navy as a whole has so many activities, it is difficult to know what to omit from so general a survey as this must be. But no navy is of any use without guns, and guns can't shoot without powder!

"POMP AND CIRCUMSTANCE": ANNAPOLIS

During the fiscal year 1915, 3,984,978 pounds of smokeless powder was manufactured at the Indian Head (Md.) powder factory. This pow-

der cost $0.341256 per pound, considerably less than it can be bought for in the open market.

There was an increase of 700,000 pounds of new powder during 1915 over 1914, due not to increase in the powder factory but to improved methods of operation. With the new nitrating house in full operation the output of the Indian Head plant for 1916 will be about 5,000,000 pounds and for the fiscal year 1917 about 6,000,000 pounds.

Owing to the abnormal rise in the cost of raw materials on account of the war, the cost of the powder now being manufactured is higher than for the last fiscal year, the raw materials for which were nearly all contracted for before the war.

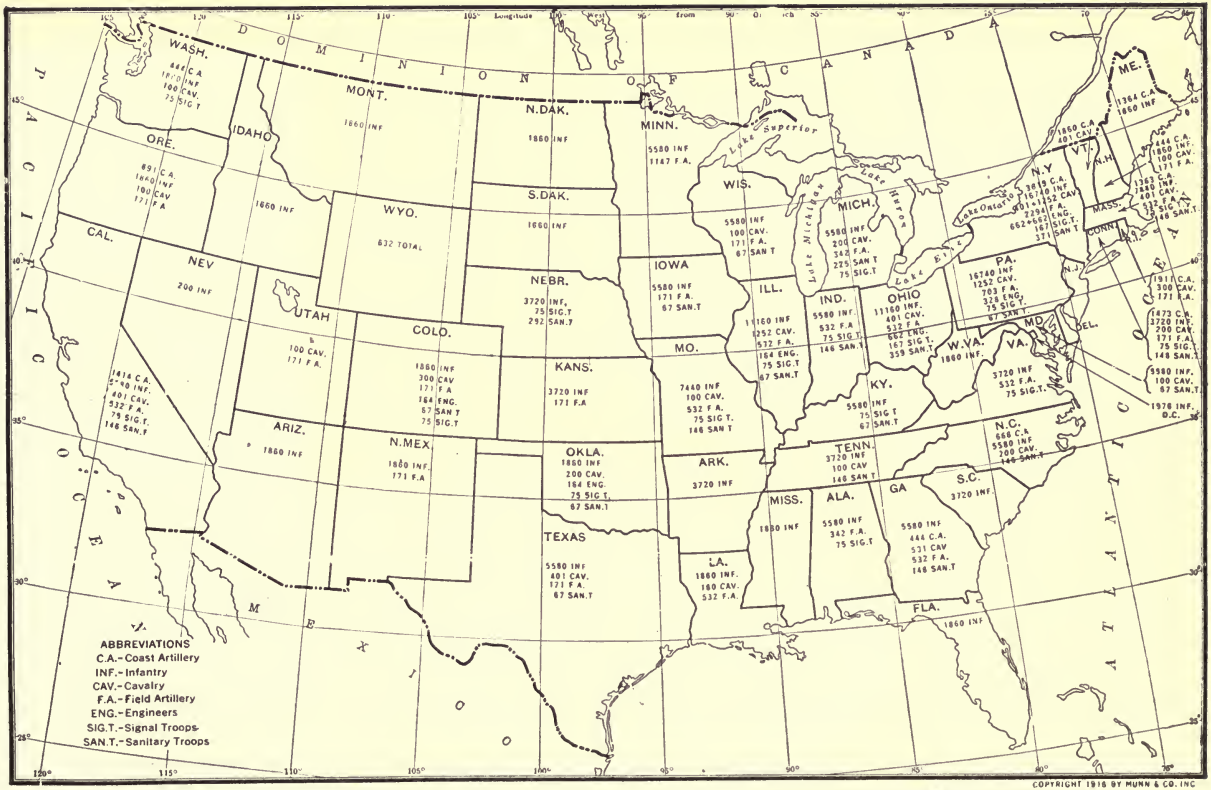
The amount of powder delivered by the private plants during 1915 was 3,112,868 pounds, but now, because of the increase of powder making facilities at Indian Head, outside contracts have been greatly reduced. At the same time, it is recognized that the facilities for the production of smokeless powder and other explosives in the United States enormously increased owing to the demands of the belligerents for these materials form a naval asset of great value.

PEACE SERVICES

Of the functions of the Navy in time of peace much could be written, but space forbids. Perhaps nothing sums its labors up better than the words of Mr. Daniels in transmitting his report to President Wilson. He states that during 1915 "our ships have charted islands in the Caribbean and in Alaskan waters. They have been privileged to carry thousands of non-combatants from the war zone to places of refuge. They have protected Americans and American interests on the coasts of war-torn Mexico. They have afforded a patrol of our coasts to preserve neutrality. They have carried aid to flood sufferers in China and given succor to the starving in Samoa. They have transported marines to preserve peace in the revolutionary period in Haiti and have acted as protector and custodian of the interests of that island in the days of its travail. Maneuvers, war games, target practice, reviews, have given evidence of its readiness and fitness. The increase in its personnel and in their training, the improvement in the *morale* of officers and men, and the perfection of its organization tell the story of a year of effort crowned with most gratifying advance.

"The Navy is strong. It must be stronger to justify the confidence the country reposes in it . . . as the first arm of defense of our shores and the protection of the liberties of our people."

THE TERRACE AT BANCROFT HALL, ANNAPOLIS



ACTUAL PEACE STRENGTH OF MILITIA OF THE UNITED STATES

TOTAL OFFICERS AND MEN, 129,398

CHAPTER XXIII.

THE ARMY

By C. H. CLAUDY

TERRITORIAL

IN its territorial organization the Army is arranged in departments, as follows:

The Eastern Department.—Embracing the New England States, New York, New Jersey, Pennsylvania, Delaware, Maryland, District of Columbia, Virginia, West Virginia, North Carolina, South Carolina, Kentucky, Tennessee, Georgia, Florida, Alabama, Mississippi, the post of Ft. Logan H. Roots, Arkansas, the Coast Defenses of New Orleans and Galveston, the Panama Canal Zone, and the island of Porto Rico, with the adjacent islands and keys. Headquarters are at Governor's Island, N. Y.

The Southern Department includes the States of Texas (except the Coast Defenses of Galveston), Louisiana (except the Coast Defenses of New Orleans), Arkansas (except the post of Ft. Logan H. Roots), Oklahoma, New Mexico and Arizona. Headquarters are at Ft. Sam Houston, Texas.

The Central Department.—Embracing the States of Ohio, Michigan, Indiana, Illinois, Wisconsin, Minnesota, North Dakota, South Dakota, Iowa, Missouri, Kansas, Nebraska, Wyoming (except that part included in the Yellowstone Park), Colorado and the post of Ft. Missoula, Mont. Its headquarters are at Chicago, Ill.

The Western Department includes the States of Washington, Oregon, Idaho, Montana (Ft. Missoula excepted), Yellowstone Park in Wyoming, California, Nevada, Utah and Alaska. Its headquarters are in San Francisco, Cal.

The Hawaiian Department.—Embracing the Hawaiian Islands and their dependencies. Headquarters, Honolulu, Hawaii.

The Philippine Department embraces all the islands of the Philippine Archipelago, with headquarters at Manila, P. I.

ORGANIZATION

Internally the Army is divided as follows:

The General Officers, General Staff Corps, Adjutant General's Department, Inspector General's Department, Judge Advocate General's Department, Quartermaster Corps, Medical Department, Medical Reserve Corps, Dental Corps, Contract Surgeons, Corps of Engineers, Ordnance Department, Signal Corps, Bureau of Insular Affairs, Chaplains and Military Academy.

Commands in the field are organized as Cavalry, Field Artillery, Coast Artillery, Infantry and Philippine Scouts.

On September 20, 1916, there were authorized 11 Major Generals and 30 Brigadier Generals, 244 Colonels, 231 Lieutenant Colonels, 658 Majors, 2,099 Captains, 2,562 First Lieutenants, 1,369 Second Lieutenants and 85 Chaplains as officers, a total of

7,289 for a total authorized strength of 117,038 enlisted men.

THE NEW ARMY BILL

But the new Army act of June 22, 1916, makes changes which will be far-reaching in effect, increasing the authorized strength to 175,000 men.

According to the new law the Army of the United States shall consist of the Regular Army, the Volunteer Army, the Officers' Reserve Corps, the Enlisted Reserve Corps, the National Guard while in the service of the United States, and such other land forces as may be authorized by law.

The Regular Army of the United States, including the existing organizations, is to consist of sixty-four regiments of Infantry, twenty-five regiments of Cavalry, twenty-one regiments of Field Artillery, a Coast Artillery Corps, the Brigade, Division, Army Corps and Army Headquarters, with their detachments and troops, a General Staff Corps, the retired list, additional officers, professors, Corps of Cadets, general Army service detachment, and detachments of Cavalry, Field Artillery and Engineers, and the band of the United States Military Academy, the post non-commissioned staff officers, the recruiting parties, the recruit depot detachments and unassigned recruits, the service school detachments, disciplinary guards and disciplinary organizations, Indian Scouts, and other officers and enlisted men as may be provided.

It is expressly stipulated in the new law that the enlisted personnel of all organizations of the Regular Army shall be at all times maintained at a strength not below the legal minimum strength.

The total enlisted force of the Regular Army, excluding the Philippine Scouts and the enlisted men of the Quartermaster, Medical and Signal Corps, and unassigned recruits, must not, except in actual or threatened war, exceed 175,000 men.

ACTUAL STRENGTH OF THE ENTIRE MILITARY ESTABLISHMENT JUNE 30, 1916

Branches of Service	Officers	Enlisted Men	Total
General officers	25	.....	25
Staff corps and departments	1,012	10,896	11,908
Engineers	207	1,948	2,155
Cavalry	778	14,646	15,424
Field Artillery	262	5,664	5,926
Coast Artillery Corps	728	19,185	19,913
Infantry	1,604	36,123	37,727
Miscellaneous	....	7,303	7,303
Total regular army	4,616	95,765	100,381
Philippine scouts	182	5,430	5,612
Aggregate	4,798	101,195	105,993

an Adjutant General's Department, an Inspector General's Department, a Judge Advocate General's Department, a Quartermaster Corps, a Medical Department, a Corps of Engineers, an Ordnance Department, a Signal Corps, the officers of the Bureau of Insular Affairs, the Militia Bureau, the detached officers, the detached non-commissioned officers, the Chaplains, the Regular Army Reserve, officers and enlisted men on

1915 STRENGTH

But even before the passage of the recent Army bill there was a considerable discrepancy between what was authorized and what was in existence. At the close of the fiscal year 1915, the most recent date for which a report is available, there were appropriations available for the maintenance of an Army and all of the accessory employees aggregating 5,023 officers and 102,-

Photo Underwood & Underwood

Troops getting under way at Galveston, Texas

The Lewis Machine Gun

Copyright International Film Service

Machine Guns in use on border

Field Bakery

SOME ARMY ACTIVITIES

985 enlisted men. Of these 67,000 men were mobile army troops, 20,000 coast defense troops, and the balance Hospital Corps, quartermaster men and other employees. Of this total number, about 29,000 were on service outside continental United States, leaving about 46,000 mobile army troops and about 13,000 coast defense troops within our borders.

The actual strength of the entire military establishment on June 30, 1915, by branches of service, is shown in the table on page 282.

DISTRIBUTION

Prior to the Spanish War the United States kept its Army at home, with the exception of a few officers and men opening up communication in Alaska and in foreign diplomatic service. How becoming a world power affects Army life is well shown in the accompanying table.

GEOGRAPHICAL DISTRIBUTION OF THE UNITED STATES ARMY

Geographical Distribution	Officers	Enlisted Men	Total
In the United States	3,502	64,756	68,258
In Alaska	23	747	770
In the Philippine Islands:			
Regular army	455	12,454	12,909
Philippine scouts	182	5,430	5,612
In China	45	1,361	1,406
In Porto Rico	37	670	707
In Hawaii	322	9,199	9,521
In the Isthmian Canal zone	192	6,151	6,343
Troops en route and officers at other foreign stations	40	427	467
Total	4,798	101,195	105,993

APPROPRIATION

The expenditures by the War Department for all purposes during the fiscal year 1915 amounted to $166,355,172.99. Of this amount, $9,518,227.02 was for the civil establishment, that is, maintenance of the War Department as an Executive Department, buildings and grounds in and around Washington, national and military parks, monuments, national cemeteries, support of national homes for disabled soldiers and sailors, miscellaneous public works, etc.; $45,092,760.02 for rivers and harbors, and the balance, $111,744,185.95, for military purposes, including the support of the Army, Military Academy, militia, fortifications, arsenals, military posts and miscellaneous items.

The various items, showing expenditures for 1915 and authorized for 1916, are shown in the table on the next page.

ENLISTMENTS

Perhaps nothing in the new Army bill is of greater importance than the sections referring to enlistments and reserve. Hitherto enlistments have been for three years. Now they are to be for seven years, three in active service and four in the reserve. There is also a provision designed to attract capable men who do not desire so long an active service, that an enlisted man serving a year honorably may, on the recommendation of certain superior officers and at the discretion of the Secretary of War, be furloughed to the Regular Army Reserve.

To further enlistments the President is authorized to utilize the services of postmasters of the second, third and fourth classes in procuring recruits for the Army. For each recruit secured by a postmaster, who is accepted for enlistment, the postmaster is to receive $5.

In addition to military training,

EXPENDITURES FOR 1915 AND APPROPRIATION FOR 1916

	Expenditures for the fiscal year ended June 30, 1915	Appropriations for the fiscal year ending June 30, 1916
Civil establishment (War Department proper).		
Salaries, contingent expenses, etc. (including office of public buildings and grounds)	$1,897,151.91	$1,925,598.00
Civil public works and miscellaneous (exclusive of rivers and harbors):		
Military and national parks	587,560.14	407,060.00
Buildings and grounds in and around Washington	373,950.81	314,490.00
National cemeteries	328,912.21	312,070.00
Miscellaneous objects	955,170.07	379,760.00
National home for disabled volunteer soldiers	4,193,665.65	4,931,009.50
Miscellaneous relief acts, etc	1,181,816.23	1,973,471.20
Total civil establishment	$9,518,227.02	$10,243,458.70
Military establishment:		
Support of the army	$98,076,645.78	$96,519,195.87
Military academy	996,035.84	1,069,813.37
Militia	5,007,814.98	5,440,000.00
Fortifications	6,300,355.59	6,060,216.90
Arsenals	481,096.19	653,600.00
Military posts and miscellaneous	882,237.57	570,924.99
Total military establishment	$111,744,185.95	$110,313,751.13
Rivers and harbors	45,092,760.02	33,989,811.64
Grand total	$166,355,172.99	$154,547,021.47

soldiers in active service will hereafter be given the opportunity to study and receive instruction upon educational lines to increase their military efficiency and enable them to return to civil life better equipped for either industry or general business. Civilian teachers are to be employed to aid Army officers in such instruction, and "part may consist of vocational education either in agriculture or the mechanic arts."

PAY OF ENLISTED MEN

The monthly pay of enlisted men is provided for rather liberally. Of course, clothes, medical and dental attention, quarters and rations are furnished in addition to the following monthly pay:

Quartermaster sergeant, senior grade, Quartermaster Corps; master hospital sergeant, Medical Department; master engineer, senior grade, Corps of Engineers; and band leader, Infantry, Cavalry, Artillery and Corps of Engineers, $75. Hospital sergeant, Medical Department; and master engineer, junior grade, Corps of Engineers, $65. Sergeant, first class, Medical Department, $50. Sergeant, first class, Corps of Engineers; regimental supply sergeant, Infantry, Cavalry, Field Artillery and Corps of Engineers; battalion supply sergeant, Corps of Engineers; and assistant engineer, Coast Artillery Corps, $45. Assistant band leader, Infantry, Cavalry, Artillery and Corps of Engineers; and sergeant bugler, Infantry, Cavalry, Artillery and Corps of Engineers, $40. Musician, first class, Infantry, Cavalry, Artillery and Corps of Engineers; supply sergeant, mess sergeant and stable sergeant, Corps of Engineers; sergeant, Medical Department, $36; supply sergeant, Infantry, Cavalry and Artillery; mess sergeant, Infantry, Cavalry and Artillery; cook, Medical Department; horseshoer, Infantry, Cavalry and Artillery, Corps of Engineers, Signal Corps and Medical Department; stable sergeant, Infantry and Cavalry; radio sergeant, Coast Artillery

Corps; and musicians, second class, Infantry, Cavalry, Artillery and Corps of Engineers, $30. Musician, third class, Infantry, Cavalry, Artillery and Corps of Engineers; corporal, Medical Department, $24. Saddler, Infantry, Cavalry, Field Artillery, Corps of Engineers and Medical Department; mechanic, Infantry, Cavalry and Field Artillery and Medical Department; farrier, Medical Department; and wagoner, Infantry, Field Artillery and Corps of Engineers, $21. Private, first class, Infantry, Cavalry, Artillery and Medical Department, $18. Private, Medical Department, and bugler, $15.

LOSSES

With the prospect of so great an increase in enlistment as the new bill calls for, it is natural to inquire, first, what the general loss to the Army may be, and, second, if existing methods of recruiting, even with the help of postmasters, will serve.

Enlisted men of the Regular Army, to the number of 27,020, were discharged upon expiration of service during the year ending June 30, 1915. During the preceding year the number of discharges upon expiration of service was 25,027, and during 1913 it was 12,095. These numbers are, respectively, 19.7, 20, 11.3 per cent of the whole number of enlisted men in service or of enlistment contracts in force during these years.

Losses from all causes other than expiration of service in 1915 numbered 14,517. During the preceding year the losses were 12,487, and during 1913 they were 13,254. These numbers are, respectively, 10.6, 9.97 and 12.4 per cent of the whole number of enlisted contracts in force during these years.

The desertions from the Army during the year ending June 30, 1915, aggregated 4,435, which is 3.23 per cent of the whole number of enlistment contracts in force. This is a slight increase over the percentage (3.10) for 1914. The number of desertions during the year 1915 is 553 greater than the number reported during 1914, but 16 less than the number reported in 1913. The increase in the number of desertions over that for 1914 is natural, because the number of enlistment contracts in force during 1915 is 12,007 greater than in 1914. The increase in desertions is due in part to the fact that there were nearly 1,800 more original enlistments in 1915 than in 1914, it being a well known fact that desertions are frequent during the early periods of service.

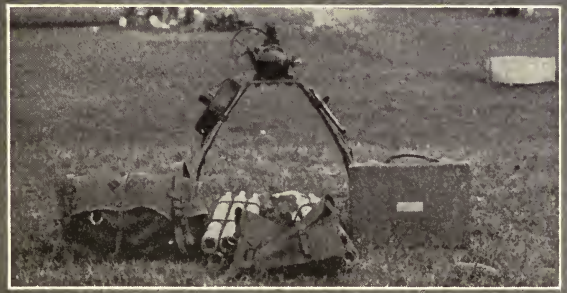
ENLISTMENT METHODS

Recruiting officers at stations report whether applications for enlistment are the result, wholly or in part, of any form of advertising. The result of each of the several methods of advertising during the fiscal year ended June 30, 1915, is given on the second page following.

RECRUITING FOR THE ARMY

The general recruiting detail at the beginning of the fiscal year 1915 consisted of 129 commissioned officers and 831 enlisted men. At the end of that year the detail consisted of 124 officers and 636 enlisted men. Sixty-five officers are regularly on duty at general recruit depots and 59 officers on duty at recruiting stations.

Within the year enlistments and re-enlistments numbered 48,813, including 44,427 for the line of the Army, 1,031 for the Hospital Corps, 1,096 for the Quartermaster Corps, 834 for other staff departments, and 1,425 for the Philippine Scouts. The enlistments numbered 31,939, of whom 4,795 had former service. Of these enlistments, 30,342 (4,255 with former service) were for the line of the Army, 339 (120 with former service) for the Hospital Corps, 175 (139 with former service) for the Quartermaster Corps, 284 (78 with former service) for other staff departments, and 799 (203 with former service) for the Philippine



WIRELESS WITH THE ARMY IN THE FIELD

ENLISTMENTS THROUGH ADVERTISEMENT

Methods of Advertising	Number of Applications
Sight of recruiting flag and station	64,703
Recruiting poster	28,197
In parks and squares	22,589
Canvass by recruiting parties	11,900
Recruiting circulars	11,611
Recruiting booklet	5,792
Special circulars issued by recruiting parties	5,341
Newspaper advertising	4,159
Handbills	3,734
Advertising cards	905
Electric recruiting sign (2 districts)	696
Personal letters from recruiting officers	545
Baseball team (1 district)	435
News items in newspapers	139
Photographs (1 district, July, August and September)	135
Postal cards	41
Total	160,922
Not the result of advertising	6,575
Total number of applicants reported upon	167,497

Scouts. The re-enlistments for the line of the Army numbered 14,085, for the Hospital Corps 692, for the Quartermaster Corps 921, for other staff departments 550, and for the Philippine Scouts 626; in all, 16,874.

It should be noted that the Army is very particular about men it accepts for enlistment. The total number of enlistments (48,813) for 1915 does not show that 130,206 men who applied were rejected for one cause or another—minority, small size, aliens, illiteracy, disease, imperfect physique, etc.

With so satisfactory a condition existing and with the new inducements provided, it is not felt that any special difficulty will obtain in recruiting 175,000 men in a reasonable period.

RESERVE

The new enlistment law must necessarily operate to procure an Army Reserve of no mean proportions within a very few years. According to the new law, this Reserve is to consist of all the enlisted men in the Reserve at the time the act was passed (a number so small as to be disregarded), all enlisted men who sign for seven years and serve three honorably, such men as may be furloughed into the Reserve before completing three years' active service, and all who hold an honorable discharge from the Army, with good character, are yet physically qualified and not over forty-five years old, who may enlist in the Reserve.

Reservists of the Army receive $24 a year in time of peace; if mobilized, the Reservist takes status of a regular enlisted man and pay as such. But in addition, on reporting physically fit for duty, a called-out Reservist will receive $3 for each month he has belonged to the Reserve, as well as transportation and subsistence from home to mobilization point.

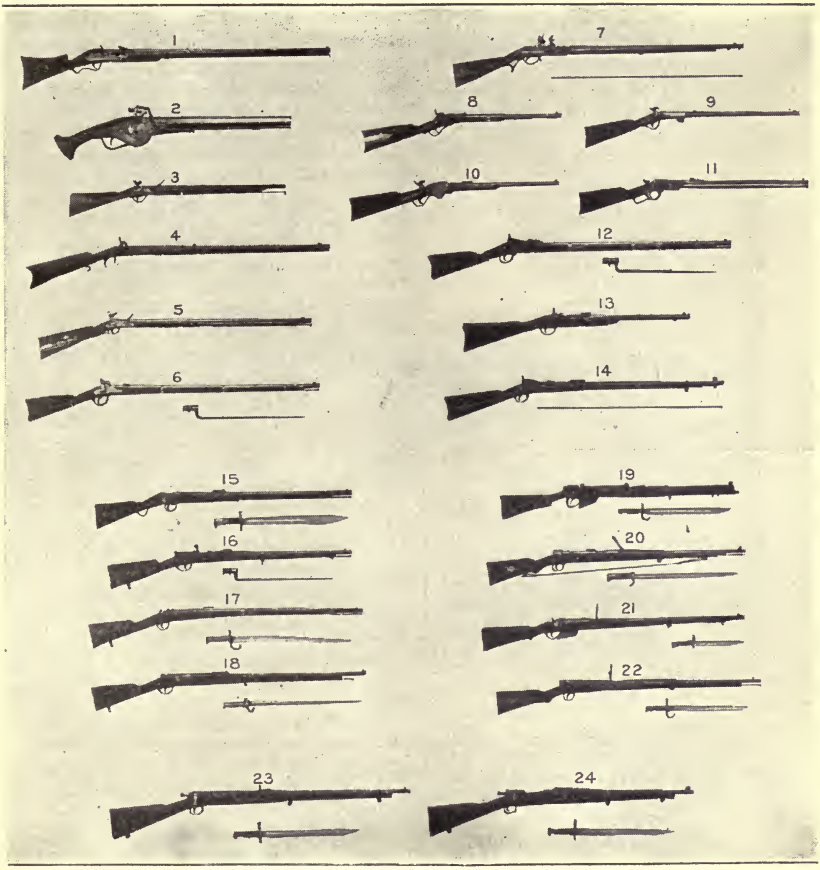
To secure a Reserve of officers available for service in the Army, as officers of the Quartermaster Corps and other staff corps and departments, as officers for recruit rendezvous and depots, and as officers of volunteers, there is organized an Officers' Reserve Corps. Members of the Officers' Reserve Corps are not subject to call for service in time of peace.

The President is authorized to appoint and commission as Reserve officers in all grades up to and including that of major, such citizens

as are found qualified to hold such commissions.

ORGANIZED MILITIA

The Organized Militia in the various States according to the latest returns had a reported strength of 8,705 commissioned officers and 120,693 enlisted men. Of this force, 1,406 officers and 5,446 enlisted men belong to the staff and non-combatant branches, 440 officers and



THE DEVELOPMENT OF MILITARY SMALL ARMS

1, Old matchlock arquebuse. 2, Pistol showing wheel lock. 3, Flintlock musketoon. 4, American or squirrel rifle. 5, American flintlock army rifle of 1815. 6, Springfield rifle, 1863. 7, Breech loading American army musket, 1824. 8, Sharp breech loading carbine, 1852. 9, The Burnside carbine, a Civil War weapon. 10, Spencer repeating breech loading gun of 1860. 11, Henry magazine breech loading musket, 1860. 12, The Allin alteration Springfield rifle, 1865. 13, The English Snider alteration. 14, Springfield rifle, 1873. 15, English, Martini-Henry rifle. 16, Prussian needle gun. 17, French Chassepot. 18, French Lebel rifle of 1893. 19, English Lee-Enfield, 1903. 20, Late model of German Mauser. 21, Austrian Mannlicher. 22, Latest Mauser model, used by Japan. 23, 1902 and 1908 Krag-Jorgensen, used by the United States. 24, Latest American military rifle.

7,438 enlisted men belong to the Coast Artillery, and 6,859 officers and 107,809 enlisted men to the mobile branches (Engineers, Field Artillery, Cavalry and Infantry). The mobile troops, with auxiliary forces, are organized into twelve tactical divisions. The National Guard of New York in its organization is the closest approximation to a complete divisional unit.

On a divisional basis there is an excess of Infantry units equivalent to 23 regiments, and a deficiency in necessary elements as follows (1915):

48 Troops Cavalry.
74 Batteries Field Artillery.
88 Companies Machine Guns.
5 2/3 Battalions Engineers.
2 Battalions Signal Corps.
8 Field Hospitals.
20 Ambulance Companies.
11 Medical Supply Detachments.
13 Sanitary Detachments.

In connection with this part of what would be a volunteer army in time of war it is interesting to note the issue of rifles to rifle clubs and schools. Since the provisions of the Act of Congress of 1914 have been put into effect, 1,780 rifles and 1,446,560 rounds of ammunition have been issued to 261 rifle clubs, of which 195 drew both rifles and ammunition, 65 ammunition only, and 1 rifles only. Twenty schools have taken advantage of this act and have drawn 1,015 rifles, 622 carbines, and 118,400 rounds of ammunition. The rifles are of the model of 1898; the carbines of the model of 1899 (both Krag-Jorgensens). The War Department has endeavored to make it as easy as possible for the clubs and schools to obtain arms and ammunition under the provisions of this act.

AERONAUTICS

It is impossible in a short sketch of this kind to take up and epitomize the work of all the various arms of the service. The Army organization is too vast a machine and its activities too great to permit brief treatment. Its own yearly reports require three large volumes of a thousand pages each, not to mention the thousands of documents and orders continually issued.

But the aeronautical work of the Signal Corps is too vital to be omitted.

There is no blinking the fact that up to the present the United States, the cradle of aviation, has been most laggard in Army development of flying, and this in spite of the fact that it was the Signal Corps trials of 1908 and 1909 which established the heavier-than-air machine as a factor in warfare.

The Signal Corps possesses an Aviation School on North Island, San Diego Bay, which is divided into two main departments—the training and the experimental and repair department. The former is devoted to the training of student officers for junior military aviators, the instruction of enlisted men in flying, and the training of suitable enlisted men for aviation mechanicians. The officers are given theoretical and practical courses in the art of flying; in the construction, operation and repair of aeroplanes and aeronautical motors; in meteorology, and in the navigation of the air. Enlisted men on flying duty are instructed in the art of flying and in the operation and care of aeroplanes and motors. Aviation mechanicians are trained to repair aeroplanes and motors by a thorough shop course. The personnel of the training course consists of the officers assigned as instructors, two expert civilian instructors in flying, and an expert civilian instructor on motors.

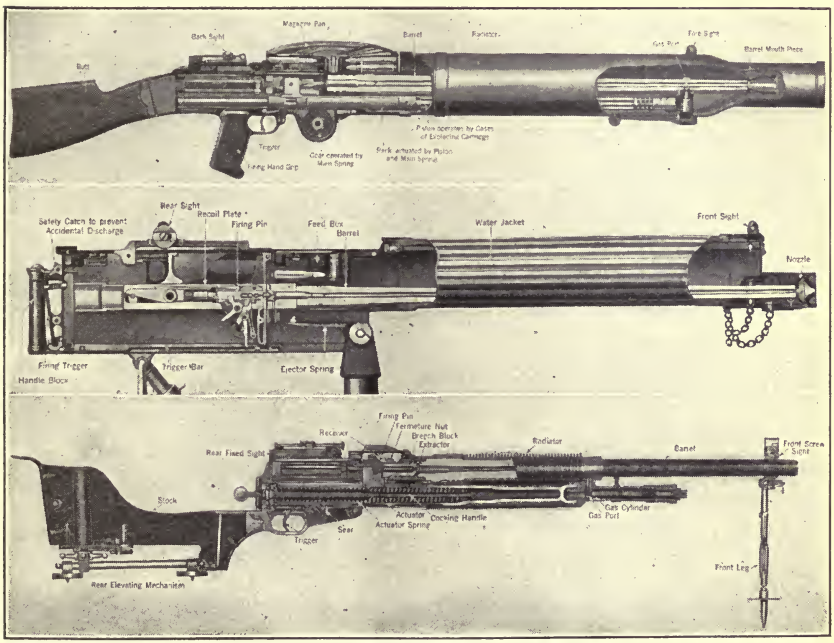
The experimental and repair department is composed of the officer in charge, an aeronautical engineer, an aeronautical mechanical engineer, and five civilian aviation mechanicians. It is charged with the conduct of experiments pertaining to machines, motors and appurtenances, the study of new types, and the repair and reconstruction of aeroplanes and motors,

During the year 3,458 flights of a total duration of 1,269 hours and 50 minutes were made and 1,730 passengers carried.

The most important thing which militated against military aviation was lack of men. The new law is liberal with the aviation section of the Signal Corps, providing for one colonel, one lieutenant-colonel, eight majors, twenty-four captains, and 114 first lieutenants, to be selected from among officers of the Army at large of corresponding grades or from among officers of the grade below who are qualified as military aviators.

Special inducements as to pay and privileges are offered aviation officers and the bars have been taken down for the married men and those over thirty years of age. It has been a vital necessity, for the United States has hardly 100 trained aeroplane pilots, both military and civilian. England and France have each over 3,000.

It is a fact that the new law and enlarged appropriation ($13,280,000 plus two items of $300,000 for the purchase of sites for aeronautical stations) should go far, even if not the whole way, in providing our Army with capable aerial eyes in sufficient numbers to place the nation which invented the flying machine at least on a par with any enemy likely to confront it.



The Lewis Gun (top) The Maxim Gun The Benet-Mercier Gun (bottom)

MODERN MACHINE GUNS

Punching holes in packages of bills
Receiving the bills

The top of the macerator
The macerator in action
Cutting the bills in two

DESTRUCTION OF OLD MONEY

CHAPTER XXIV.

UNCLE SAM'S MONEY

PART I.—THE TREASURY

TO the casual visitor at Washington, the Treasury is, outside, a beautiful example of architecture and, inside, a bewildering succession of offices, vaults, cages and rooms with people and money in them. He is taken by a guide to view monetary exhibits

$76,640,000 ON THE SHELVES IN ONE BIN AT THE TREASURY

which pass his comprehension, perhaps sees the interior of a vault with more wealth than Midas ever dreamed of, and leaves with the confused impression that his Uncle Samuel is very rich indeed, but seems to need a lot of people and paraphernalia to take care of his cash!

As a matter of fact, the activities of the Treasury Department are so varied and so numerous that only by a careful study of the laws under which it operates or a reading of its huge reports can any adequate idea be gained of its work. As for Uncle Sam's money and the way it is taken care of, it may fairly be stated that no visitor to the Treasury really gets any adequate idea.

For instance, how much money is there in the United States? Not wealth—money and wealth are entirely different. How many people, uninformed, will guess that, if the United States had to depend only on its *money*, and not at all on its *wealth*, it could pay its own expenses but for two years before going broke? Yet such is the case.

The general stock of money in the United States June 30, 1915, was $3,989,400,000. Of the total stock, $420,200,000, or 10.53 per cent, was in the Treasury as assets. Coin and other money in national and other reporting banks, exclusive of those in the island possessions, amounted to $1,448,600,000, and, including $312,100,000 cash in Federal Reserve Banks, the sum of $1,760,700,000, or 44.14 per cent of the total stock of money, was held by banks, the remaining $1,808,500,000, or 45.33 per cent, being outside of the Treasury and banks. The amount in circulation, exclusive of coin and other

money in the Treasury as assets, is $3,569,200,000, or $35.44 per capita, an increase of $167,200,000 and a per capita increase of $1.09 over 1914.

The accompanying table shows how this money is distributed.

Of the total money in circulation, $1,662,981,438 is in gold coin and certificates, $414,961,583 is United States notes, Treasury notes and Federal Reserve notes, $785,393,047 is in National Bank notes and $705,883,506 in silver coin and certificates. Thus nearly half (46.59 per cent) of our money in circulation is gold or its representative.

THE WEALTH OF GOLCONDA IN A TREASURY VAULT—BILLS AND COIN

Except on the Pacific Coast, where coin is still preferred to paper, the bulk of all monetary transactions of ordinary life is accomplished with gold or silver certificates, bank notes or the like. Held in some suspicion when first authorized (February 25, 1862), the familiar "greenback" is in the public mind to-day "as good as gold," even though it be but a silver certificate. For the people know that for every

AMOUNT OF MONEY IN CIRCULATION

Year ended June 30	Coin and other money in the United States	Coin and other money in Treasury as assets		Coin and other money in reporting banks		Coin or other money not in Treasury or banks			In circulation, exclusive of coin and other money in Treasury as assets		Population	Per cent of increase of population per year
		Amount	Per cent	Amount	Per cent	Amount	Per cent	Per capita	Amount	Per capita		
1906	3,069,900,000	333,300,000	10.86	1,010,700,000	32.92	1,725,900,000	56.22	20.39	2,736,600,000	32.32	84,662,000	1.7
1907	3,115,600,000	342,600,000	11.00	1,106,500,000	35.51	1,666,500,000	53.49	19.36	2,772,900,000	32.22	86,074,000	1.7
1908	3,378,800,000	340,800,000	10.08	1,362,900,000	40.34	1,675,100,000	49.58	19.15	3,038,000,000	34.72	87,496,000	1.6
1909	3,406,300,000	300,100,000	8.81	1,444,300,000	42.40	1,661,900,000	48.78	18.68	3,106,200,000	34.93	88,926,000	1.6
1910	3,419,500,000	317,200,000	9.27	1,414,600,000	41.37	1,687,700,000	49.36	18.68	3,102,300,000	34.33	90,363,000	1.6
1911	3,555,900,000	341,900,000	9.61	1,545,500,000	43.46	1,668,500,000	46.93	17.75	3,214,000,000	34.20	93,983,000	4.0
1912	3,648,800,000	364,300,000	9.98	1,563,800,000	42.86	1,720,700,000	47.16	17.98	3,284,500,000	34.34	95,656,000	1.7
1913	3,720,000,000	356,300,000	9.58	1,532,300,000	41.73	1,811,400,000	48.69	18.61	3,363,700,000	34.56	97,337,000	1.7
1914	3,738,300,000	336,300,000	8.97	1,630,000,000	43.62	1,772,000,000	47.41	17.89	3,402,000,000	34.35	99,027,000	1.7
1915	3,989,400,000	420,200,000	10.53	1,760,700,000	44.14	1,808,500,000	45.33	17.95	3,569,200,000	35.44	100,725,000	1.7

greenback in their hands, calling for a silver dollar, there actually is a silver dollar waiting for them—or for whoever calls with the "bill" to ask for it—in the vaults at Washington.

In the first years of the war, when the "greenbacks" were first made legal, the total amount authorized was $450,000,000; the highest amount outstanding at any time was $449,338,902, on January 30, 1864.

The United States notes issued and redeemed, by denominations, during the fiscal year 1915, are set out in the table on page 296.

It must not be supposed, however, that this sum, in circulation and constantly redeemed and reissued, forms the bulk of the redemption work done at the Treasury. National Banks issue notes which have to be redeemed, and the size of this financial undertaking may be imagined when it is stated that the

COUNTING COINS BY MACHINES

By the canceling and retiring of these notes as they were received in the Treasury, the amount outstanding was reduced more than $100,000,000 when the process was stopped in 1878, Congress requiring the notes to be reissued when redeemed. At that time the amount outstanding was $346,681,016, and it has not been changed since.

money received by the National Bank Redemption Agency during 1915 was $782,633,567, the largest for any year, and an increase of $75,876,965 over 1914. Of the amount received, 46.53 per cent came from banks located in New York City. The number of packages was 45,532, containing 76,287,975 notes, with an average value of $10.03.

Payments for notes redeemed was made as follows: By Treasurer's checks, $122,230,578; by remittances of new United States currency, $307,667,490, and gold, silver and minor coin, $28,220; and by credit of $340,482,729 in various accounts.

The notes assorted and delivered amounted to $764,926,023, of which sum $130,389,450, or 17.05 per cent, was fit for use and was returned to banks of issue in 92,952 packages. The remainder, $634,536,573, or 82.95 per cent, was delivered to the Comptroller of the Currency, $330,-110,347.50 in 191,068 packages, as unfit for use, to be destroyed and replaced by new notes sent to the banks of issue, and $304,426,225.50, in 25,839 packages, for destruction and retirement from circulation against deposits for that purpose.

Securities to be destroyed are delivered to the so-called destruction committee, composed of representatives from the Secretary's Office and from fiscal bureaus concerned. Some idea of the amount of work handled by this committee may be had from the fact that during the year just closed 377,364,188 redeemed notes (paper money) of a nominal value of $1,541,131,111, were destroyed, as well as large quantities of other securities.

Securities to be destroyed are counted, the count verified, the paper cut in pieces or punched and the pieces then fed to a macerating machine, which, with water and power, makes a pulp of what once was money, which is largely used by souvenir makers to construct mementoes of Washington!

But a "bill" is not destroyed without cause. Formerly any soiled or creased bill sent in was condemned, a new one put in its place, and the old one destroyed. Now, however, Uncle Sam has a wonderful money-laundering machine which washes, resizes, dries and irons out paper currency unfit for circulation but not yet torn or badly worn. The result is a "bill" hardly to be told from new. There are laundering machines at Washington and at the sub-treasuries at New York, Philadelphia and Chicago.

Naturally, it takes fine paper to stand washing—and, indeed, no finer paper than that used for "greenbacks" can be bought.

The paper is made by a secret process under Treasury supervision by annual contract under competitive bids.

The Bureau of Engraving and Printing, a branch of the department, designs, under the direction of the Secretary, engraves and prints the notes and certificates complete. This currency is delivered to the Treasurer in packages of 4,000 notes,

UNITED STATES NOTES ISSUED AND REDEEMED

Denominations	Outstanding June 30, 1914	Fiscal Year, 1915		Outstanding June 30, 1915
		Issued	Redeemed	
One dollar	$1,823,218	.....	$3,678	$1,819,541
Two dollars	1,367,225	.....	3,612	1,363,612
Five dollars	202,996,730	$103,580,000	104,453,570	202,123,160
Ten dollars	93,753,256	52,880,000	38,675,260	107,957,996
Twenty dollars	8,470,812	880,000	1,258,180	8,092,632
Fifty dollars	1,690,275	600,000	259,900	2,030,375
One hundred dollars	3,775,000	.....	791,300	2,983,700
Five hundred dollars	3,867,500	50,000	1,168,500	2,749,000
One thousand dollars	29,927,000	2,000,000	13,376,000	18,551,000
Five thousand dollars	.....	.....	.....	.....
Ten thousand dollars	10,000	.....	.....	10,000
Total	347,681,016	159,990,000	159,990,000	347,681,016
Unknown, destroyed	1,000,000	.....	.....	1,000,000
Net	346,681,016	159,990,000	159,990,000	346,681,016

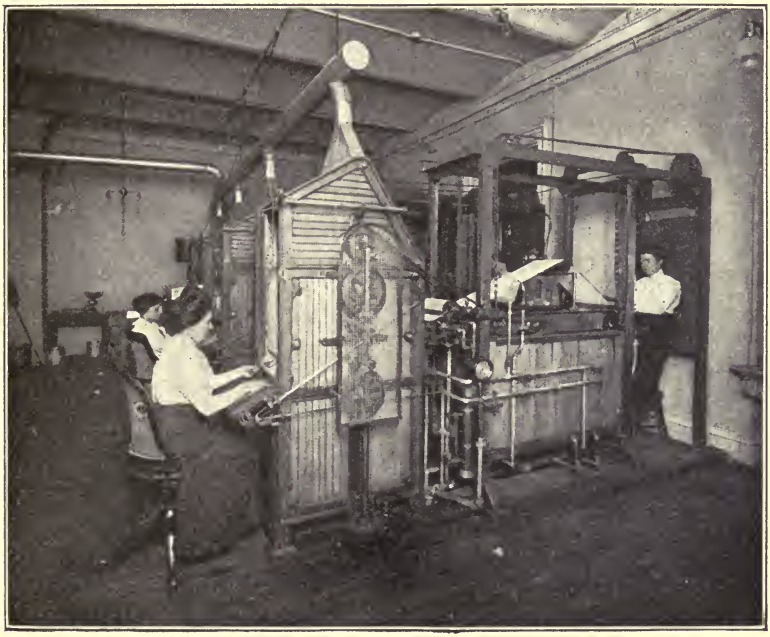
the product of 1,000 sheets of paper. Such a package is taken as the unit from which to reckon the cost.

Allowing for every item of expense attending making, issuing and the redeeming of paper currency, the average cost is as follows:

Total average expense of 4,000 notes issued	$52.50
Total average expense of 4,000 notes redeemed	8.54
Aggregate average expense of issue and redemption	$61.04

"greenback" into circulation. And it is staggering to find the total cost for redemption of 299,455,985 pieces, and issuing of 280,174,317 pieces (1915) to total $4,316,626.44 in this year.

But a curious little fact commends itself to the thoughtful. Though it costs this sum to issue and redeem paper currency, that sum is more than saved by the prevention of abrasion of gold and silver coin. If we had not the notes, we would



THE BILL WASHING MACHINE ALWAYS ATTRACTS ATTENTION AND IS FREQUENTLY LOANED TO EXPOSITIONS

It is interesting in this connection to know that the life of a United States one dollar note averages 3.14 years, while the five dollar note averages 2.73 years. The average life of all denominations of United States notes is 3.22 years.

It actually costs the Government, then, about 1.526 cents to put a use the coin. The Government saves the loss by abrasion by letting paper be "abraded" and keeping the coin in its vaults. Think it over!

With all his multitudinous activities, and the huge sums of income and outgo with which he deals, Uncle Sam has so modern and accurate a system of bookkeeping that

he knows every day just where he stands. And curious though it may seem, his whole balance sheet may be written on a page smaller than that required for the same information of many a big private industry. Below is a condensed balance sheet, showing just where Uncle Sam's money comes from, when it arrives in the Treasury, and just where it goes to when it is paid out. The sheet covers years 1914 and 1915.

RECEIPTS AND DISBURSEMENTS FOR THE FISCAL YEARS, 1914 AND 1915

Account	1914	1915	Increase	Decrease
Receipts				
Customs	$292,320,014.51	$209,786,672.21		$82,533,342.30
Internal revenue:				
Ordinary	308,659,732.56	335,467,887.14	$26,808,154.58	
Corporation and income tax	71,381,274.74	80,201,758.86	8,820,484.12	
Lands	2,571,774.77	2,167,136.47		404,638.30
Miscellaneous	50,855,941.14	59,441,800.12	8,585,858.98	
Receipts of the District of Columbia	8,752,937.11	9,790,474.18	1,037,537.07	
Total	734,541,674.83	696,855,728.98	45,252,034.75	82,937,980.60
Deduct moneys covered by warrant in year subsequent to the deposit thereof	505,970.59	637,462.47	131,491.88	
Total	734,035,704.24	696,218,266.51	45,120,542.87	82,937,980.60
Add moneys received in fiscal year but not covered by warrant	637,462.47	1,692,561.07	1,055,098.60	
Net available	734,673,166.71	697,910,827.58		36,762,339.13
Disbursements				
Legislative	13,468,827.66	13,577,399.19	108,571.53	
Executive	564,134.36	3,065,880.50	2,501,746.14	
State Department	5,253,911.78	4,908,606.79		345,304.99
Treasury Department	60,139,856.78	71,107,291.59	10,967,434.81	
War Department, civil	2,237,069.37	2,215,535.19		21,534.18
Navy Department, civil	860,873.02	885,870.15	24,997.13	
Interior, civil	22,656,130.62	29,069,642.99	6,413,512.37	
Post Office Department proper	2,236,202.24	1,894,873.64		341,328.60
Postal deficiencies		6,636,592.60	6,636,592.60	
Department of Agriculture	22,208,141.12	29,131,112.07	6,922,970.95	
Department of Commerce	10,958,882.40	11,499,098.76	540,216.36	
Department of Labor	3,768,904.05	3,783,611.86	14,707.81	
Department of Justice	10,188,151.26	10,434,871.97	246,720.71	
Independent offices	3,232,179.61	5,738,773.78	2,506,594.17	
District of Columbia	12,756,971.18	13,220,662.97	463,691.79	
Total civil and miscellaneous	170,530,235.45	207,169,824.05	37,347,756.37	708,167.77
Military Establishment, including rivers and harbors	173,522,804.20	172,973,091.73		549,712.47
Naval Establishment	139,682,186.28	141,835,653.98	2,153,467.70	
Indian Service	20,215,075.96	22,130,350.70	1,915,274.74	
Pensions	173,440,231.12	164,387,941.61		9,052,289.51
Interest on the public debt	22,863,956.70	22,902,897.04	38,940.34	
Total ordinary disbursements	700,254,489.71	731,399,759.11	41,455,439.15	10,310,169.75
Net			31,145,269.40	
Surplus	34,418,677.00			
Deficit		33,488,931.53		

Part II.

THE BUREAU OF ENGRAVING AND PRINTING

By Hon. JOSEPH E. RALPH, Director

THE Bureau of Engraving and Printing was organized under act of July 11, 1862, and its first work was an attempt to apply machinery to the trimming and separating of Treasury notes, such notes having been printed by private bank note companies and then forwarded to Washington for signature of the Register of the Treasury, and the Treasurer of the United States. This work, however, soon became physically impossible for these officers to perform and a large corps of clerks was employed for this purpose. This was very expensive, and to obviate it authority was granted by Congress to have these signatures engraved in the plates and the seal of the Treasury imprinted on the notes, and steps were taken to procure the necessary machinery to perform this work of sealing in the Treasury Department.

Following the successful execution of this work, it was determined that an effort should be made to perform, under official supervision, the entire mechanical work upon United States securities, and authority therefor was granted by the act of July 11, 1862, which authorized the Secretary of the Treasury, in case he deemed it inexpedient to procure such notes by contract, to cause them to be engraved, printed and executed at the Treasury Department, and as prior to the passage of this act none of the public securities had been engraved or printed otherwise than by private contract, this act may be regarded as the organic act of the Bureau of Engraving and Printing.

From time to time following this date the work done by private companies was gradually absorbed by the bureau until all of the printing of the securities of the Government was done at that bureau, and the last work taken over by it from private contractors was the printing of the postage stamps which the bureau undertook in 1894.

The bureau is the Government factory for producing its paper money, bonds, revenue, postage and custom stamps, checks, drafts and all important documents printed from engraved plates. The output in the fiscal year just ended, June 30, 1916, had a value of approximately 3½ billions of dollars.

Putting it in a more concrete form, the daily output of United States notes, gold and silver certificates and National bank notes, is two and one-quarter million notes, having a face value of nine million dollars, and weighing over three and one-half tons. If laid out flat they would cover nine acres, and if placed end to end the daily output would make a chain two hundred and fifty miles long.

Each day forty million postage stamps are manufactured, which would cover approximately seven acres, or make a chain of stamps six hundred and twenty miles long. The value of each day's output is nearly seven hundred and fifty thousand dollars. Six hundred em-

ployees are engaged in their manufacture. Fifty-one different kinds of postage stamps in denominations from one cent to five dollars are made for the United States and its insular possessions. They are printed in fifteen distinctive colors.

Another important part of the Bureau's work is internal revenue stamps, through which an annual income of over five hundred million dollars is collected for Uncle Sam. These stamps are of larger sizes than postage stamps and while the daily output is only twenty million stamps, they would cover twenty acres if spread out in single sheets and weigh six and one-half tons. More than three hundred different varieties are issued.

It is a noteworthy fact that such enormous quantities of securities are produced year after year at this establishment without the loss of one cent to the Government, and is a testimonial to the integrity and ability of the employees, not one of whom is bonded, as well as to the efficiency of the system under which they operate. Be it further said to the credit of these employees that not one has ever engaged in the counterfeiting of the securities manufactured by this bureau.

The bureau employs the most expert designers, engravers, plate printers and other artisans requisite to a large plate printing establishment, several of whom entered its service during the Civil War shortly after the bureau was organized, and who are capably occupying positions of trust and responsibility.

The number of employees in the bureau engaged in the making of paper money is 2,800; in making postage stamps, 600; in making revenue stamps, 600, and about 100 in making bonds, checks, commissions and various other classes of work; the total number of employees being 4,100; 2,200 of whom are females. The maximum and minimum salaries of males is $6,600 and $320, respectively, per annum, and of females, $2,100 and $300, respectively, per annum.

An idea of the business growth of the United States may be gleaned from the fact that the Government Bureau of Engraving and Printing delivered 11,771,283,150 perfect postage stamps during the fiscal year 1916. The paper required for this work amounted to 1,100,000 pounds, and to make this paper 4,500 large pine trees were ground to a pulp.

Had these trees been converted into lumber, 85 well-appointed bungalows could have been built. The paper itself would make an edition of 3,500,000 twelve-page seven-column newspapers. As the stamps were printed from intaglio-engraved plates in which the entire surface is covered with ink and wiped with a cloth that leaves the ink only in the engraved lines, the amount of ink required was 625,000 pounds. But only 10 per cent of this was actually applied to the stamps, the balance being wiped off. The gum on the back of the stamps is made by scientifically roasting the highest grade of tapioca flour, such as is used for making pudding, and as 350,000 pounds were used, all of the inhabitants of a large city would have been given their fill of tapioca pudding for one meal with the material used.

The sheets of one hundred stamps each, as sent to the post offices, piled upon each other, would make a shaft over six and three-fifths miles high, and placed end to end would make a strip 16,500 miles long, and as there are ten rows of stamps in each sheet, a strip of single stamps would be 165,000 miles long, and would girdle the earth six times, with something over.

The Bureau of Engraving and Printing prints all of the securities of the United States Government, which embraces checks, drafts, bonds, paper money, revenue, customs, parcel post and postage stamps and certificates of deposit for the Post Office Department.

Hardening the Plate
An Engraver at Work

Vault for Rolls and Plates

The Transfer Press
The Ruling Machine

HOW PLATES ARE FABRICATED

It has been our constant endeavor not only to safeguard our stamps and circumvent their counterfeiting, but to make them really artistic. When you comprehend the small space allowed for artistic embellishment, you necessarily must marvel at the results we obtain.

The engraving division is the cornerstone of the bureau and the bulwark of our securities. In this division every form of security has its origin, and the most artistic and skilled engravers that the world produces are employed here.

Steel engraving is the perfection of art as applied to securities; it differs from painting and sculpturing, inasmuch as the engraver who carves his work on steel plates must deliberately study the effect of each infinitesimal line. Free hand with a diamond-pointed tool, known as a graver, aided by a powerful magnifying glass, he carves away, conscious that one false cut or slip of his tool or miscalculation of depth or width of line will destroy the artistic merit of his creation, and weeks or months of labor will have been in vain. In no other form of printing can the beautiful, soft, and yet strong effects in black and white be obtained as in steel engraving. The introduction of cheap mechanical process work has superseded the beautiful creations of our master engraver commercially, and now we find the art limited to the engraving of securities as applied in the Bureau of Engraving and Printing.

The work in this division is classified and divided so that the engravers become specially skilled in some particular branch of the art. For instance, they are classified as portrait, script, square letter and ornamental engravers. Each is confined to his own specialty, and thus becomes unusually expert, the result being that not only better work is secured, but a greater amount is turned out in a given time, and what is of greater importance, increased security is obtained. The individual excellencies and characteristics of a number of men are impressed upon every stamp issued. Therefore, it would be as difficult for one engraver to make a perfect reproduction of a Government plate as it would be for the reader to reproduce an absolute facsimile of his or her own signature, and, strange as it may seem, no one has yet accomplished this feat.

To the credit of the engravers and employees of this division, it should be stated that in the history of the bureau none of its employees has ever engaged in counterfeiting.

When it is determined to issue a new stamp, the matter is discussed by the officials having in charge the several branches of the service involved, and the conclusions reached are embodied in a model made by a trained designer, which is submitted for the criticisms of the officers who discussed the matter in the first place. The model is then modified in accordance with the criticisms, and is finally approved by the Postmaster General.

The approved design is placed in the hands of the engravers who cut it upon a small piece of annealed steel. After the approval of a proof of this engraving, the piece of steel is heated red hot in cyanide of potassium and hardened by suddenly dipping it into oil and water. This single engraved subject is duplicated four hundred times upon the larger plates that the stamps are printed from, by means of the transfer process.

This is a method of reproducing engraving devised many years ago by Jacob Perkins, an inventive American, who may be considered the father of the present method of duplicating bank note and stamp plates. It consists of making a reversed duplicate or mold of the original engraving by rolling a soft, annealed steel roll upon it in the transfer press. Being accurately guided and held by the mechanism of this press, continued rolling under high

The Bureau of Engraving and Printing
The Façade

Power Plate Printing
Wings of the New Plant

THE BUREAU OF ENGRAVING AND PRINTING

pressure forces the soft steel of the roll into the engraved lines of the original design, and forms an exact counterpart, in relief, of it. This roll, being hardened, is used to duplicate the engraving by the same process, upon a soft steel plate, which it will do a great number of times before wearing out, reserving the original engraving, or die as it is called, for making additional rolls. The original engraving is never printed from except to make what are known as die-proofs.

The paper, being printed wet, contracts on drying, and the mathematically correct layout of the engraved plate bears only an approximate relation to the desired printed sheet. The paper we print to-day will vary in shrinkage from that we print to-morrow. As the physical properties of the tree govern the expansion and contraction of the paper made therefrom, no two sheets are exactly the same size. The actual difference in size of the individual stamp is too minute to be readily discernible, but becomes a serious factor when the row is twenty stamps long as we now print the sheets.

But that is not all. To smooth the paper for the operation of gumming, it is subjected to 500 tons pressure in a hydraulic press, and if very dry, it stretches but little, but if the day is damp and humid it stretches perceptibly. The contraction of the gum itself is a factor, and the atmospheric conditions still another. Our perforating machines have not human intelligence, and they blindly perforate the sheets alike until their adjustment is changed. Therefore, the best we can do is to average the adjustment and it is only by chance that all the perforations are exactly central. Of course, it will be understood that typographic printing, being done on dry paper, eliminates many of these problems, and no great feat is performed in perfectly centering the perforations on a dry printed stamp.

The present method of printing stamps is accomplished upon what is known as the "four plate power press." Four plates are used in order that the operation of inking, wiping, polishing and taking the impressions may be done simultaneously. This press requires the service of a printer to polish the plates, one girl to lay the sheet in position and another girl to take it off after printing.

After each two hundred sheets are printed, they are counted and dried. To secure a flat surface for subsequent operations, they are pressed in a hydraulic press.

They are next gummed by passing beneath a glass roller which is bathed in a solution of dextrine (which forms the gum), and the sheets are then carried by grippers through a drying chamber in which the gum is dried in less than thirty seconds. Just before leaving the gumming machine, the sheets are carried through a device that breaks the gum into innumerable cracks and materially prevents subsequent curling.

The printed and gummed sheets of 400 stamps are now fed through a rotary perforator that perforates the stamps in one direction and cuts the sheets in half. Another perforator of the same construction perforates the stamps crosswise and makes another cut, thereby quartering the original sheets.

After a close and rigid inspection, these sheets are counted and made into packages for final packing for shipment to the post offices.

The new building for the use of the Bureau of Engraving and Printing has been occupied since early in the spring of 1914. This building is the most modern type of factory building in the United States. While the exterior of the building is classic and monumental in style, the wings, which are utilized for factory purposes, are constructed along modern factory lines.

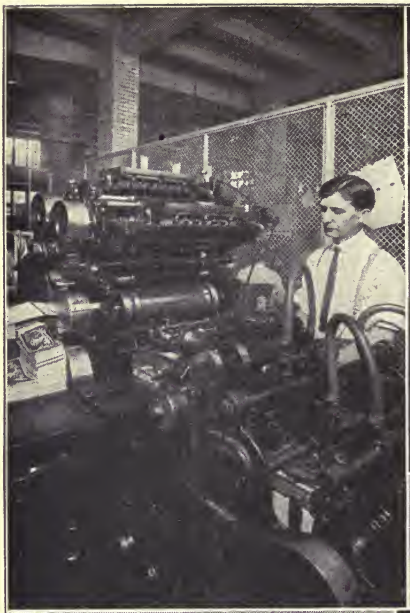
The building is about 505 feet

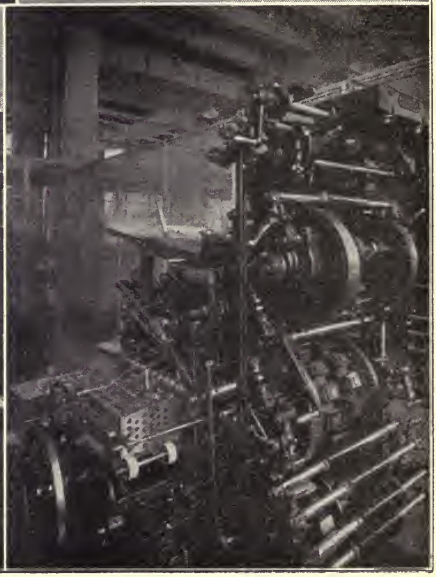
Photo Clinedinst Studio

Engravers at Desks
Motor-Driven Hand Presses

Engraving and Transferring
Old-Style Hand Presses Still in Use

SOME OF THE DEPARTMENTS





Putting on the Seal and Numbering
Sizing the Bills

The Ink Mills
The Final Step; Sealing and Numbering

THE PAPER COMES OUT MONEY

long, fronting on Fifteenth Street, with a depth of about 296 feet and a height of 105 feet. It has a basement, four stories and attic, and is in the form of the letter "E," but with four wings instead of three, making three open end courts, two of which are approximately 230 feet long to the end of the wing. The two inner wings, to allow space for the driveways, are about 30 feet shorter.

There is a mezzanine gallery on each floor, having a total length of about 1,800 feet on all floors where installed, which is used by the public for viewing the more interesting operations of the bureau, and this may be done without the possibility of any loss of a security or interference with the workmen.

None of the employees are permitted to leave the building during the lunch hour, as each individual employee is held accountable for the securities which he or she is handling during the working hours, and to permit them to leave the building would necessitate a check or count, which would be too expensive.

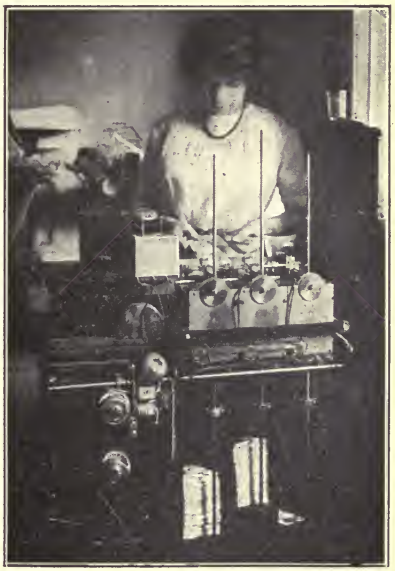
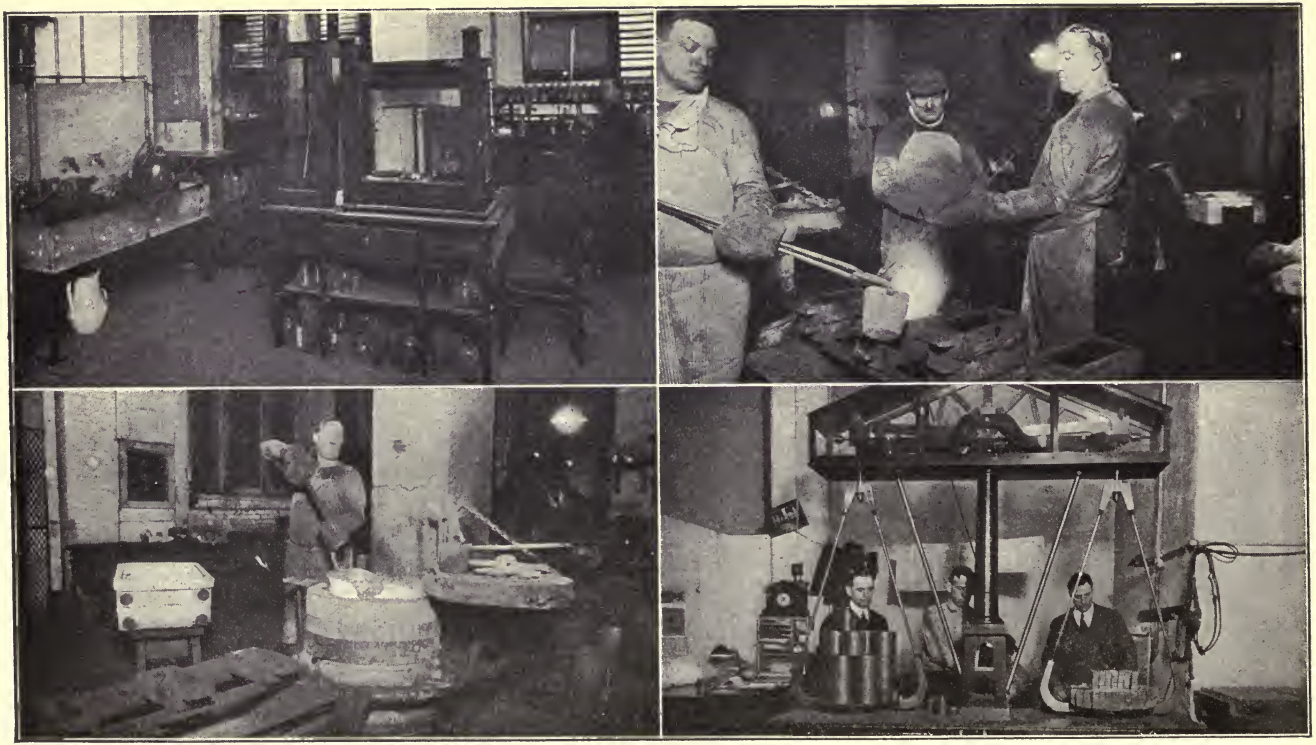


Photo Harris & Ewing

HAND VS. MACHINE COUNTING



Laboratory in the Melting and Refining Department
Feeding the Crucible with Foreign Gold Coin

Pouring Gold Certificate Bars
Weighing Fine Gold Merchant Bars

VIEWS IN THE U. S. ASSAY OFFICE AT NEW YORK

Part III.

UNITED STATES ASSAY OFFICE AT NEW YORK

By Hon. VERNE M. BOVIE, Superintendent

THE United States Assay Office opened its doors at 30 Wall Street in 1854. It occupied the same historical building until its age made its demolishment necessary in 1914. In 1910 a new eight story building was built adjoining the old in the rear, and with an entrance on Pine Street. Since that time its operations have been carried on there. Appropriations have now been made by Congress for the erection of a new building on the site of the old Wall Street building, to be joined to the present Pine Street building, so that for the indefinite future the office will continue its service from the same historic site on which it started.

From deposits of a few thousands in value in 1854, the importance of the office has increased to such an extent that for the fiscal year 1916 the aggregate value of the deposits received and handled amounted to the huge sum of $325,958,585.38. Of this $321,609,643.73 was gold and $4,348,941.65 silver. $253,957,895.26 was from foreign countries and $72,000,690.12 from the United States. The number of deposits made was 17,338. During the year 149,867 assays were made.

The Assay Office is the great purchasing, as well as selling, agent for gold for the Government. It is the station where the crude wealth produced by our own mines, and the wealth that all the world sends to our shores in the ordinary activities of commerce, is converted into values of United States dollars and cents.

We purchase gold in any amounts from $100 in value up—in any form suitable for mint purposes and from any source. We receive gold dust from Alaska and Dutch Guiana; bullion from Mexico, South and Central America; gold and silver coins from all the countries of the world; old gold and silver jewelry from pawnbrokers and jewelers; fine gold bars and mixed bullion, and light weight and mutilated United States coin.

The purchase is made at the actual gold value at the uniform rate of $20.67 per fine ounce. Silver is paid for in fine silver bars, which, in turn, are marketed by the depositors at the current price in the open market.

The process by which the crude bullion is turned into fine metal is itself an interesting one. The office is divided into four general departments: the Deposit and Weigh Room, where the metal is first received, weighed and melted; the Assay Department, where its value and fineness are determined; the Melting and Refining Department, where it is refined and cast into fine bars; the Clerical Force, where the calculations are made and final payments provided for.

Immediately upon its receipt the deposit is weighed and at once sent to the Deposit Melting Room, where it is melted and thoroughly mixed and cast into bars. From the liquid

metal samples are taken during this melting from which the assays are made. These determine the proportions and fineness of the gold and silver contents. The melted deposit is again weighed in the Deposit Weigh Room, its values determined by the assays made from the samples previously taken, and payment made by check by the Superintendent drawn on the Treasurer of the United States. The bar of mixed gold and silver is then turned over by the head of the Deposit Weigh Room to the Superintendent of the Melting and Refining Department. Here it is again melted and cast into thin slabs or anodes about 18 inches long and ¼ inch thick of about the composition of two thirds silver and one third gold. These anodes are put in a muslin bag and are hung in a solution of silver nitrate and free nitric acid opposite a strip of pure silver called the silver cathode. Electric current is passed through and the silver passes from the anode to the cathode in pure silver crystals. It is scraped off into huge earthen jars and then taken to the melting room and cast into its final form of fine silver bars.

The residue remaining in the muslin bag is taken out, washed and in turn melted and cast into smaller anodes, or slabs, which in turn are taken to the gold refining room and by a similar electrolytic process the fine gold extracted. The gold is then in the form of a warty, irregular slab of gold. This in turn is melted and cast into fine bars ready for the vaults or for trade purposes.

During the refining process the base metals and by-products are taken into solution and are later precipitated by chemical reaction and recovered.

When it is realized that the ordinary deposit in its course through the office is melted five times; that not less than five and often seven or more assays are made of it; that each bar is stamped with five separate stamps; that it must be constantly weighed and re-weighed and checked and re-checked; some conception may be had of the care and attention to detail required in the office.

Experimental work, looking to the discovery of better and more efficient methods, is being constantly carried on. The office uses the most perfect appliances obtainable for its work and seeks constantly to increase the efficiency and perfect the products of its labor.

With the increased development of the commerce of the country and the recent almost phenomenal growth of its financial power, the importance of the work of the Assay Office, as related to the financial and business world, constantly increases. It is now the largest and most completely equipped office of its kind in the world and through its doors is destined to pass in continuing volume the golden stream that will make the United States the financial master of the world.

Weighing Sample for Assay
Cupel Being Placed in Muffle Furnace

Washing the Gold Cornet Samples
Parting Silver from Gold

ASSAYING BULLION AT THE U. S. ASSAY OFFICE AT NEW YORK

Refining Silver in Flat Cells
Refining Gold

Separating Silver from Gold in Vertical Cells
Stamping and Numbering Merchant Bars

THE ELECTROLYTIC REFINING OF GOLD AND SILVER AT THE NEW YORK ASSAY OFFICE

PART IV.

HOW COINS ARE MINTED

By Hon. A. M. JOYCE, Superintendent
U. S. Mint, Philadelphia

IN the operation of providing coinage for the country the Government purchases the gold bullion from anyone who offers it for sale at the rate of one dollar for each 23.2 grains of pure gold, or about $20.67 per ounce, and silver at the market quotations when requested. This bullion, if in an unrefined state, is refined and separated from all foreign matter. It is then sent to the mint and delivered to the superintendent of the melting department. Nine parts of pure gold or silver are mixed with one part of copper (alloy) and the mixture melted in crucibles placed in the gas furnaces. It is then poured into molds and produces ingots about 12 inches long, 1½ inches thick, and from 1 to 2 inches wide, depending upon the denomination to be made.

Granulations of these ingots or melts are taken and sent to the assaying department and assayed for their fineness. If found correct, the ingot is stamped with the number and fineness of the melt; if not correct, it is condemned and remelted. This then places the responsibility for the legal fineness of every coin upon the assayer. The ingots passed by the assayer as correct are then delivered to the superintendent of the coining department.

The superintendent of the coining department upon receiving the ingots from the superintendent of the melting department passes them cold, through ten-inch hardened steel rolls, eighteen or twenty times, depending upon the denomination, each driven by a fifty horse-power electric motor, each draft reducing the thickness, and adding to the length of the strip until the last draft leaves it of such a thickness that a coin of the desired denomination cut from it will weigh as nearly the right weight as it is possible to roll. After rolling the ingot to the required thickness of the coin, or denomination required, it is put through the cutting machine where the blank, or planchet, is punched out, leaving the clippings to be returned to the melting room, there to be re-melted and returned to ingots.

The blanks are then sent to the selecting tables, where women designated as selectors examine the blanks and pick out all imperfect pieces or cuts, known as "chips."

The gold planchets or blanks are then sent to the weighing room, where they are passed through the automatic weighing machines.

In practice it is impossible to cut all the gold planchets so that they will each weigh precisely the standard weight, therefore, the law permits a tolerance or variation of the weight from standard of one-half grain on double-eagles and eagles, and one-quarter grain on half and quarter-eagles.

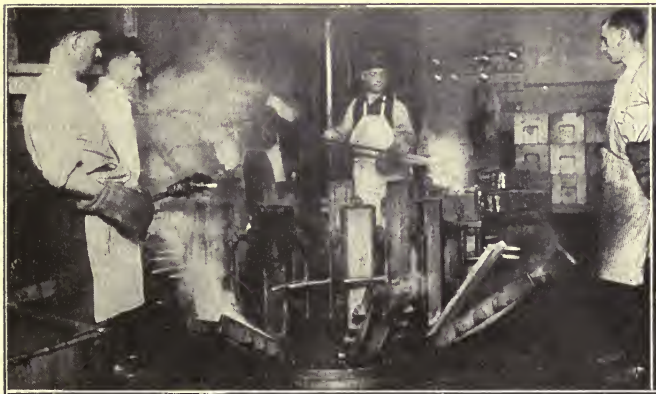
The machines, known as automatic weighing machines, then weigh each of the planchets separately, and

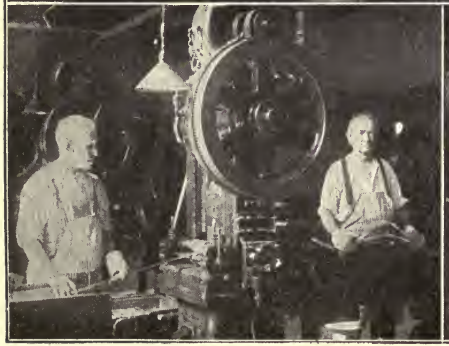
those found one-half grain above standard are deposited in a separate box, and marked "heavies," and those found standard and one-half grain light are placed in a separate box and marked "lights." The "heavies" that are found above the limit of tolerance are passed through a machine known as the shaving machine and reduced to within the limit of tolerance, one-half or one-quarter grain, depending on the denomination, to good "heavies" one-half and one-quarter grain above standard. Those that are found too light are condemned and go back to the melting pot. After coinage, all coins are again re-weighed. At this stage the metal, after going through the various operations, is very hard, and, before it can be stamped, it is necessary to anneal or soften the same, otherwise it would be very destructive to the dies when the piece is being struck on the coining presses. The blanks are placed in a gas annealing furnace, where they remain in the retort until they become a "cherry red," when they are dropped from the furnace into water to keep them from oxidizing. After coming out of the water they are cleaned in a weak acid solution and dried out in centrifugal machines. They are then sent to the milling or upsetting machines, where the edge is turned up on the blank. The blanks are now bright and soft and ready for stamping or coining. In the coining room they are fed into the coining presses by automatic feeders, and the automatic fingers on the presses take one piece at a time from the bottom of the tube attached to the automatic feeder and place it between the dies, at the same time pushing the finished piece out and dropping it in a screened box at the side of the press. The upper and lower die being respectively the obverse and reverse sides of the coin, in this position it drops automatically into a collar which is internally engraved to conform to the edge of the coin, known as the reeding; at that instant the dies approach each other under a pressure of one hundred tons to the square inch, and the planchet is pressed so that the metal is driven into every corner and crevice of the engraved die, and at the same time outward into the engraving on the interior of the collar producing the reeding or rough edge. This enormous pressure is regulated by adjusting screws, which determine just how close together the two dies, upper and lower, will be brought to each other, and this adjustment is made so they shall come just close enough together to bring out every detail of the engraving.

This coinage operation proceeds at the rate of from 90 to 120 pieces coined per minute, on one press, the speed of operation being adjusted according to the size of the press. There are in the Mint at Philadelphia twenty-four coining presses of three different sizes.

After stamping, each coin is separately inspected and weighed. Six automatic inspecting machines are in use. Each machine is operated by two women who have a view of each side of the coin as it passes through the machine. The weighing is done on the automatic scales. The law permits a variation of one-half grain on double-eagles and eagles, and one-quarter of a grain on half and quarter-eagles, and one and a half grains on all silver coins, from the standard weight. The pieces that weigh above or below the standard mark are kept separate. The condemned are rolled out and sent back to the melting pot. Owing to the greater tolerance (one and a half grains) on silver the *blanks* are rolled close enough to eliminate all weighing, but *after* coinage the pieces are weighed the same as gold.

After weighing and separating the coin is counted by weight and placed in sacks; the gold in $5,000.00 packages and the silver in $1,000.00 packages, and delivered to the superintendent, who places it in vaults sub-





Casting Ingots
Punching Blanks

Cleaning and Brightening Blanks

Rolling the Strips
Inspecting Blanks

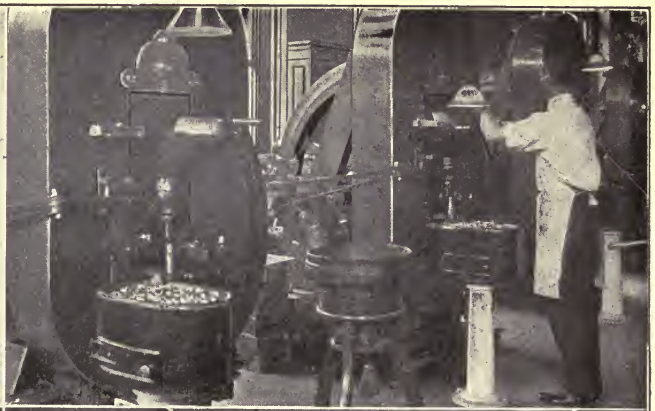
HOW OUR COINS ARE STARTED

ject to orders from the Treasurer, Assistant Treasurers and banks. All metals are delivered to the superintendent by weight as well as value. Gold and silver coin and bullion are received and delivered at 1,000 fine ounces and minor metals and coin at troy ounces. At the end of the fiscal year, i. e., June 30th, the total weight of all the ingots delivered to the coining department by the superintendent during the year stands charged against said department and the total weight of all the good coin, condemned coin, clippings, sweeps, etc., that have been delivered back by the coining department to the superintendent are placed to the credit of the coining department. Theoretically, this is supposed to balance, but if it does not the superintendent of the coining department will be held responsible for the shortage. However, in practice, the law recognizes the utter impossibility of putting such an enormous quantity of metal through all the different operations without a certain amount of loss or wastage, and this legal allowance on gold is 1/2000 part, or for every 2,000 ounces operated upon one ounce may be lost in wastage before the coining department is held responsible. On the same amount in silver the legal allowance would be two ounces.

The actual wastage in the coining department under the new system of cleaning does not average more than five per cent of the legal allowance in gold and ten per cent in silver. During the fiscal year ended June 30, 1913, the Mint at Philadelphia coined $19,678,227.50 in gold and the loss or wastage on this amount was 14.289 ounces, of the value of $284.12, and $1,936,199.75 in silver coin on which there was a loss or wastage of 22.05 ounces, of the value of $12.24, or a total value of $296.36 in gold and silver. This loss covers the workings of an entire year of $21,614,427.25. The legal percentage of wastage to the amount operated upon was gold, 1.37, and silver, 1.84.

The precautions to guard against any possible loss by carelessness on the part of the employees during the process of manufacture are about as near perfect as human ingenuity can devise. At the opening of the day, the metal is weighed and charged to the various departments and a settlement of the same is made each day before the close of work. In the morning the entire weight of the metal that stands charged to the coining department on the superintendent's books constitutes the coining department's opening balance. Every ounce of metal that is distributed among the various departments is charged to that department, and at the close of business for the day is weighed, and, if found correct, the account with the various departments is closed and the metal locked in the vaults. A detailed statement of the workings of each department, showing the amount operated upon, finished and unfinished, together with loss and wastage, is sent to the office of the superintendent of the coining department, where a tabulated record is kept from day to day. It shows by the size of the operation if the loss exceeds the legitimate loss in any one department by even less than one piece. If the loss is excessive, then the employees in that department are kept until the shortage is accounted for, or the error in calculation discovered. It generally happens to be an error in figures, or a coin or box of coin had been overlooked. On the whole it is rare for the question to arise. Once in a while in an extraordinarily large operation there might be a legitimate loss equal to the weight of a single piece in excess of the estimate of what the loss should be, and this would remain unaccounted for except as legitimate loss. It would be out of the question for any considerable theft to be committed or even to conduct a systematic pilfering on a small scale without the culprit being discovered in a short time. The

Upsetting, or Milling
Minor Coins Are Counted by Boards



The Coining Presses
Automatic Weighing of Gold and Silver Coins

HOW COINS ARE FINISHED

daily record of the day's workings kept in the superintendent of the coining department's office shows the loss or wastage on every operation.

The scales used for the weighing of bullion, coin, and metals will weigh from 1/100 part of an ounce up to 10,000 ounces at each draft.

When the coin is finished and counted it is delivered daily to the superintendent in sacks containing $5,000 in gold and $1,000 in silver in amounts that may have been coined the day previous. Out of every delivery of finished coin to the superintendent, there is taken at random by the assayer and superintendent one piece for each 1,000 pieces of gold, and one piece from each 2,000 pieces of silver, which are locked in what is known as the "pyx box," the superintendent or his representative holding the key to one combination, and the assayer the key to the other combination. Each year in February as assay commission, consisting of twelve or fifteen leading and representative citizens from all parts of the United States, the Judge of the United States District Court, Comptroller of the Currency, and the Assayer of the United States Assay Office in New York, are appointed by the President. The last named are *ex-officio* members of the Commission. He selects men who are expert chemists, scale makers, coin specialists, financiers, professors and lawyers. They meet at the Mint in Philadelphia, organize themselves into committees on counting, weighing and assaying and these committees open the "pyx box," count, weigh and assay a large number of the coins and report the result to the President. In case any of these coins are found outside the legal limit of weight or fineness, it would be sufficient grounds for the removal of the operative officer or officers.

Prior to the delivery of coin to the superintendent and before the assay pieces are taken out, the latter, by the trial separately of not less than five pieces for each 1,000 pieces embraced in the proposed delivery, must satisfy himself that the coins are within the legal limits as to the weight. If these trial pieces prove satisfactory the delivery is made, and if not satisfactory all the coins are weighed separately and such as are not of legal weight are defaced and delivered to the superintendent of the melting and refining department. As an additional precaution, from the first and two subsequent deliveries in each week of gold and silver coins of each denomination of coin delivered by the coining department two specimen pieces are taken at random, certified and enclosed by the superintendent and assayer (in the same manner as above prescribed for the Annual Assay Commission), and promptly forwarded to the director of the mint by registered mail for assay by the assayer of the Bureau of the Mint.

Metals required for the manufacture of minor coins, that is, five cent nickel and one cent bronze pieces, are purchased by the superintendent of the mint, with the approval of the director of the mint as to price, terms and quantity, after public advertisement, as provided by law. The metal so purchased is delivered to the melting department where it is converted into ingots 23 inches long, 4⅛ inches wide, and ¾ of an inch thick of legal alloy. The five cent piece, or nickel, contains 75 per cent of copper and 25 per cent of nickel, and the one cent bronze piece contains 95 per cent of copper and 5 per cent of zinc and tin. These ingots are delivered to the coining department, where they are passed through heavy sixteen-inch rolls and reduced to the thickness of the coin. About fifteen passes are required to make this reduction. Starting with the ingot 23 inches long, the strip is rolled fifteen feet and then cut in two. Each of these strips will be 12 feet long when finished. The strips are

then put through the cutting machines, where six blanks of bronze, or five blanks of nickel are punched out. These presses make 170 revolutions per minute and in that time punch 1,020 bronze blanks, or 850 nickel blanks. These blanks are passed through rotary annealing furnaces in order to make them soft and malleable before stamping. From the annealing furnace they are placed in tumbling barrels for the purpose of cleaning and brightening, and rolled in a solution of our own devising for about half an hour. No acid is used. After tumbling, or rolling the blanks are thoroughly washed and then dried in centrifugal machines. No sawdust is used in this operation. The blanks are selected and milled. The finished blanks, or planchets are taken to the coining room, where they are stamped and inspected, after which they are counted and placed in sacks. The nickel sacks hold $50 and the bronze $10. They are now ready for delivery. No pyx or special assay coins are taken from the minor coin. The tolerance on these pieces being much greater than on gold and silver, no adjusting is required.

A separate plant for the minor coinage, remote from that used in the coining of precious metals, has recently been fitted up in another part of the building. This plant is equipped with heavy machinery, and is capable of turning out a greater percentage of coin at less expense.

A separate plant also adjoins the minor coinage plant. It is known as the medal room. It is equipped with four of the latest improved hydraulic presses and other suitable machinery and appliances for the manufacture of medals and proof coin. Here are made gold, silver and bronze medals for the Government and private parties. Gold and silver medals are made from fine gold and silver.

All dies used in this and the other United States mints are made in the engraving department of this mint. All dated dies and all other coinage dies which have been in use are destroyed at the end of the calendar year. The engraver is the custodian of all dies.

The operative officers in their accounts with the superintendent are charged and credited with deliveries of bullion or coin by weight and the account kept in fine ounces. Troy weights are used, while metric weights are by law assigned to the half, quarter dollar, and dime, 15.432 grains being considered as the equivalent of a gramme.

The average cost for minting the different denominations, as shown by the cost report for the fiscal year ended June 30, 1913, is as follows:

	Per M pieces.
Double-eagles	$37.42
Eagles	13.13
Half-eagles	11.50
Quarter-eagles	10.24
Half-dollars	8.17
Quarter-dollars	6.80
Dimes	2.09
5-cent nickels	2.85
1-cent bronze	1.48

The above figures include the cost of ingot assays, ingot melting, the entire coining department and all of the superintendent's department net expenditures.

During the year all sweeps, rags used in cleaning machinery, wash water, etc., are gathered and placed in a large iron vessel, the water evaporated and the residue burnt. After being dried the residue is taken to the sweep cellar where it is passed through a jaw crusher which reduces the sweeps to one inch or less in diameter, then through a mill with sixty mesh screens which grinds the sweeps under water until they are fine enough to pass through the screen to the two settling tanks and a steam drier. The type of mill is a standard mining machine where the rolls and the pan remain stationary. It is of sufficient size to make it unnecessary to keep the mill in continuous operation and thus the men are available in other places.

LEGAL WEIGHT AND FINENESS OF THE COINS OF THE UNITED STATES, THEIR DIAMETER AND THICKNESS

Denomination	Legal Weight		Fineness Thousandths	Diameter Inches	Thickness Inches
	Grains	Troy Ozs.			
GOLD:					
Double eagle	516	1.075	900	1.350	0.096
Eagle	258	.5375	900	1.060	.080
Half eagle	129	.26875	900	.848	.065
Quarter eagle	64.5	.134375	900	.700	.050
SILVER:					
Half dollar	192.9	.401875	900	1.205	.082
Quarter dollar	96.45	.200937	900	.955	.065
Dime	38.58	.080375	900	.705	.051
MINOR:					
Five cents	77.16	.16075	75 per cent copper 25 per cent nickel	.835	.078
One cent	48	.1	95 per cent copper 5 per cent tin and zinc	.750	.058

The drier constantly agitates the wet sweeps, so that they cannot bake on the bottom. One settling tank is directly above the other and the lower contains a steam syphon which lifts the water to the upper. From the upper tank a connection leads the water back to the mill so that it may be used over again. After being thoroughly dried the sweeps are barreled, samples taken therefrom and assayed. Afterwards they are sold to the highest bidder.

During the ten years ended June 30, 1913, this mint coined $362,824,125.00 in regular domestic gold coin, $60,069.00 in Lewis and Clark gold dollars, and $14,953,488.38 in foreign (Mexican) gold coin, $7,041,294.65 in foreign silver and minor coin, $41,185,228.95 in domestic silver coin, and $24,477,958.21 in five cent and one cent pieces, making a total coinage of $450,542,164.19, or 1,547,431,704 pieces. Upon this large coinage the wastage or loss was gold, $18,491.93; silver, $12,129.15, and five and one cent pieces $4,346.22, a total of $34,967.30. The average coinage per year was $45,049,441.60 and the average loss or wastage was $3,496.73.

Since the elimination of acid for cleaning purposes and the introduction of the new cleaning method the wastage has been reduced one-half. The last three years show a very small wastage compared with former years.

During the last two years the coinage of gold and silver has fallen off considerably; the former due to the passage of an act authorizing the issuing of gold certificates on gold bars instead of the coin as heretofore, and the latter owing to a large surplus of subsidiary coin in the vaults of the Treasury and subtreasuries. On the other hand, the demand for minor coins has increased. This, no doubt, was due to the change in design of the five and one cent pieces.

A complete system of cost-keeping shows the cost of each process in coinage operations per ounce of metal handled, and per dollar of product; calculations are made monthly and a statement of the same made.

If the seigniorage on silver and minor coin is taken into consideration, it will show that this mint is the largest money making institution in the Government service. As, for instance, a troy pound of copper will yield $1.20 and a troy pound of nickel $3.75. The copper and nickel cost approximately 15 cents per pound for the former and 38 cents for the latter. The tin and zinc for alloying will be added to the copper. Silver can be purchased for about 60 cents per ounce.

CHAPTER XXV.

HOW UNCLE SAM PROTECTS HIS REVENUE

By A. H. PEARSON

PERSONAL liberty in the United States is so complete that we scarcely realize there is a powerful central government to watch over our destinies and make us comport ourselves with proper regard for the rights of citizens in our neighboring States. Frequently, an American's first real contact with Federal power comes on his return from a trip abroad, when he is advised that he must pay duty on goods that he has brought with him. He may have looked with contempt on the poor foreigner who must submit to the pettifoggery of an officious government, and he may be returning with a smug "better-than-thou" attitude, only to receive a rude shock to his complacency as the customs officials board the vessel and make him swear out a statement of his dutiable personal effects. Then, no matter if he does consider it an invasion of his rights as a freeborn American citizen, he must submit to having his trunk opened, and searched more or less perfunctorily, to make sure that he has not perjured himself. He may even be called aside to answer searching questions about a certain piece of jewelry. Now, how did Uncle Sam know that he had that trinket? For the first time he is aware of a spy system, not unlike that of Russia, which reaches out beyond our shores to foreign lands and keeps track of the purchases of the American tourists. Despite the humiliation of being treated as a

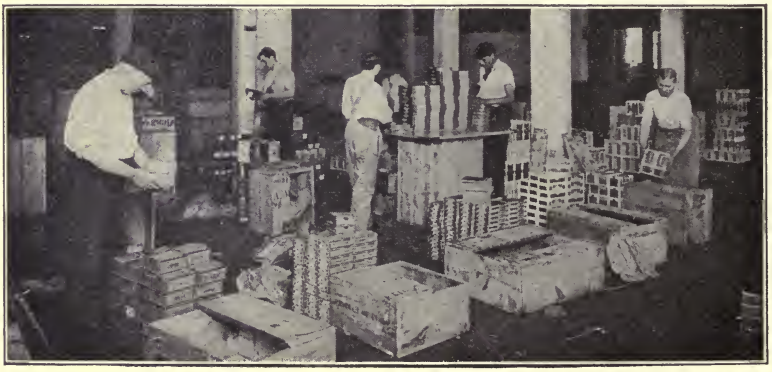
CUSTOMS EXAMINATIONS OF DRY GOODS AT THE APPRAISER'S STORES

ALL CUBAN LEAF TOBACCO MUST BE MINUTELY EXAMINED

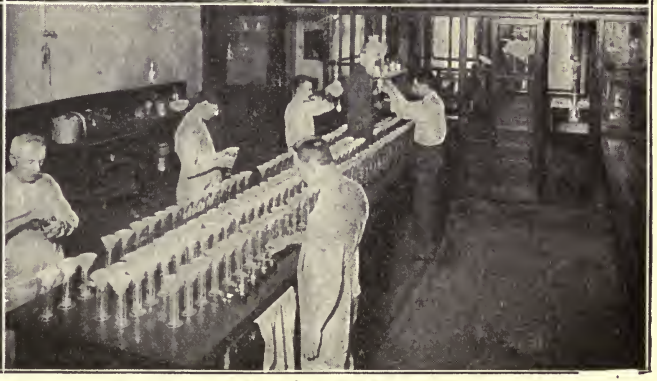
smuggler, he cannot help but feel a great respect for the omniscience of a government whose existence he barely realized up to that moment.

Although examination of travelers' baggage is the most troublesome work that the Custom House has to deal with, it is a paltry business compared with the collection of duties on general merchandise. Despite the far greater attention to personal baggage, smuggling still continues among tourists, especially those of the gentler sex, who display remarkable ingenuity in concealing their dutiable goods. One customs official hopelessly admitted that "women are born smugglers, and we cannot hope ever to suppress them."

As for general merchandise, the opportunities for smuggling are so remote, the co-operation between the Government and the importers themselves is so complete, and the penalty for smuggling is so severe as compared with the reward it offers, that practically no goods enter the country without paying duty. Take



STAMPING BOXES OF IMPORTED CIGARS AFTER THEY HAVE BEEN THOROUGHLY INSPECTED



Testing Sugar Solutions with the Polariscope
Analyzing Drugs

Assaying an Alloy
Decolorizing and Filtering Sugar Solutions

AT WORK IN THE U. S. APPRAISER'S LABORATORIES

diamonds, for instance, which one would suppose could very readily be introduced into the country because their value per size is so enormous. Not only does the Government keep track of purchasers of diamonds abroad, but the dealers do as well, and they are constantly on the lookout for smuggled stones, realizing that it is to their own interest to report any stones introduced without paying the required tariff. Furthermore, to make it unprofitable to smuggle the stones into the country, the tariff on them was reduced several years ago from 25 per cent to 10 per cent.

Some idea of the enormous amount of work involved in keeping track of the goods that enter this country may be obtained by a visit to the Appraisers' Stores on the lower west side of New York. The building is ten stories high and takes up an entire block, while across the street is an annex of no mean size. In these buildings at least 10 per cent of everything that comes into New York from foreign ports must be examined. A sample of literally everything under the sun finds its way at one time or another into the Stores, and no matter what its character may be, whether a fifty-karat diamond or a penny doll, it must be gravely considered and its value accurately and scientifically determined, so that the proper custom duty may be levied thereon. To handle this enormous quantity of material engages the attention of 938 men, of whom 134 are examiners. The duties of the examiner are exceedingly difficult. Each man has a certain classification assigned to him, and he must be prepared to determine the wholesale value of any of the various articles that might turn up under that classification. He must be able to tell of just what material or materials the article was made, how much the materials were worth in the market from which they came, and just what was the value of the labor which was expended upon it. Not only that, but he must know the market values of the materials and labor at the time of shipment. This must be determined on his own knowledge and not on the word of the shipper. He cannot depend on anyone else, but must stand on his own statement, which he must be ready to back up with incontestable evidence in case the importer carries an appeal to a higher court. He must be able to detect all the tricks with which unscrupulous manufacturers delude the ignorant public. For instance, in the textiles department, the examiner must be able to tell whether a piece of goods contains cotton, linen, or silk, and in what proportion. Having determined this, he must know the quality of the material used in making it up. If it is of silk, he must determine whether the silk is artificial or natural. If natural, what kind of silk, and where it came from. If he is in doubt about the matter, he refers a sample to the laboratory, where

Weighing Cotton Yarn Inside an Oven for Customs Determinations

An Up-to-Date Smuggler's Vest Has Thirty-six Pockets

the fabric is subjected to a chemical test in order to determine accurately what its composition may be. Naturally, an examiner acquires before long such an experience as to qualify him as an expert, an experience that it is impossible to obtain anywhere else.

Recently, curiosities, works of art, and antiques, over a hundred years old, have been admitted free of duty.

The examiner who has to appraise the work of artists has an exceedingly difficult task. In many cases it is not at all easy to distinguish between spurious and genuine old masters. The work of these examiners is of undeniable value to the country in preventing the importation of counterfeits.

Similar protection against fraud is found in the case of tea. No duty is levied on tea, but all tea must be examined for purity before being admitted into the country. In the tea room of the New York Appraisers' Stores a hundred thousand samples of tea must be tested per year. One of the photographs shows the manner of testing. Each cup contains a different sample of tea identified by a number marked on the bottom of the cup, and one of the cups contains a standard sample. Which one it is the examiner does not know, for the identification of this sample also is marked on the bottom of the cup. The examiner then proceeds to arrange the cups according to the color and taste of the tea. After the grading is done the samples are thrown away and the cups turned upside down to show the identifying numbers. All the samples on one side of the standard are passed as good tea, while those on the other side are rejected. To make sure that no error has been made the test is repeated with a second set of samples. In order to

SMUGGLING DUTIABLE GOODS IN BOOKS

detect any pigment used in the tea the leaves are mashed on a piece of white paper, and then the paper is examined with a microscope for faint spots of coloring matter. The tests are very rigid and thorough, and the United States may pride itself on having nothing but pure tea to drink.

Perhaps the most tedious work at the Stores is the testing of sugar. The tariff on sugar depends on the proportion of cane sugar the samples contain. This is determined accurately by means of a polariscope, which analyzes the light that passes through samples of the sugar syrup. In the case of sugar only samples are brought to the Stores, and as a check upon the examiner, two samples out of each barrel are given him. Each sample bears its own number, but the examiners have no means of determining which two came out of the same barrel. Nevertheless, his work must be so accurate that when like samples are paired again the readings will be practically identical.

The laboratories of the Stores are also kept busy with quantitative analyses of various chemical products, particularly in the search for alcohols in medicines, etc. There is also a section devoted to metallurgical analyses.

Obviously it would be impossible to examine every article imported into the country, and so it is the practice to bring at least ten per cent of a shipment to the Stores. If the shipment consists of but one or two cases of goods at least one case must be examined. The cases that go to the Stores are picked out at random by the examiner. He compares the contents of the case with the invoice and then investigates one of the articles under the invoice minutely in order to determine its quality. If this tallies with the specifications the case is passed. In the case of leaf tobacco, every package must be opened, in order to determine whether the leaves are good enough to be used for wrappers, which must carry a duty of one dollar and eighty-five cents per pound, or whether they are fit only for fillers, which pay thirty-five cents duty.

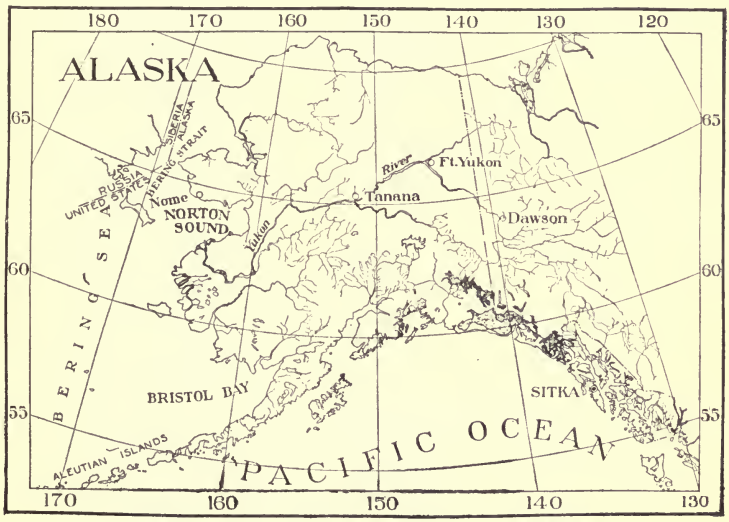
TESTING THE COLOR AND STRENGTH OF TEA

CHAPTER XXVI.

UNCLE SAM'S NON-CONTIGUOUS POSSESSIONS

ALASKA, 1867

ALASKA is a gigantic headland thrusting itself out from the extreme northwest corner of the American continent, with the waves of the Arctic Ocean washing its northern and western shores, and the Pacific bounding it on the south; only the narrow Bering Strait separates it from Siberia, while to the east lies Yukon Territory and British Columbia. About a third of its area is within the Arctic Circle. We purchased Alaska from Russia in 1867 for $7,200,000; for a long time we neglected its possibilities, and the revenue from it was small, but since 1867, and mostly within the past sixteen years, its utilized minerals, fish and furs have reached the enormous value of some $600,000,000, or more than eighty times its purchase price. About half this return must be credited to minerals, chiefly to gold, while fisheries and furs provide the other half. Of course there have been large administration expenses, but these probably do not exceed $50,000,000.



SOME OF THE PHYSICAL ASPECTS OF ALASKA

Alaska's 590,844 square miles, which we acquired for one and three-quarters cents an acre, give her almost three times the area of France, and more than double that of Texas. This area falls into four natural divisions: the Arctic Slope region, with a maximum elevation of 3,000 feet; the Central Plateau, 3,000 to 5,000 feet; the Rocky Mountain system, entering from Yukon and stretching across the country in a northeasterly direction; and the Pacific system, including the Alaskan, St. Elias, and "Panhandle" ranges, with such peaks as Mt. Crillon, 15,900 feet, the active volcano Mt. Wrangell, 17,500 feet, Mt. St. Elias, 18,024 feet, and Mt. McKinley, towering to the height of 20,300 feet, and taking rank as the highest on United States soil, and the thirteenth highest in the world.

The greatest river system of Alaska is that of the Yukon and its tributaries, the Koyukuk and the Tanana. This system provides 3,000 miles of navigable water. The Kuskokwim, another important river, is navigable for 600 miles. There are several fine lakes, among them the 160-mile reach of Nikhkak, in the rugged Sitkan district.

The climate is milder than might be expected from the high latitude. The interior, of course, presents rigorous conditions, but the coastal regions of the Pacific are beneficially affected by a warm current similar to that of the Gulf Stream. These regions have a copious rain-fall; at Sitka the average is 80 inches, compared with 44.6 inches for New York City.

The old belief that Alaska could never have any real agricultural value is disappearing. The Government experimental work, for which the main station is at Sitka, has resulted in producing at Coldfoot, 60 miles north of the Arctic Circle, 8-inch cucumbers, 19-inch rhubarb, 4-inch potatoes, and 8-pound cabbages. Lettuce is especially crisp and delicious, and turnips of good quality attain a weight of 16 pounds. Along the coast, seaweed and fish guano make excellent fertilizers. Here the heavy rains prevent grain from being raised, except for forage; but in the interior, and particularly at Rampart, very satisfactory results have been obtained. Of the capital cities of the United States, 31 record as low degrees of temperature as Sitka, and 4 are colder than Valdez, while the winter of Juneau is usually milder than that of Washington, D. C. Roses, lilacs, and English ivy thrive in the neighborhood of Seward, and southeastern Alaska boasts fifty species of birds, among them the song sparrow and the hermit thrush.

Juneau, the capital, with its quaint shops and its streets that terrace to the water, is picturesque and lively. It has good schools, churches, clubs, and hospitals, a library, a theater, a chamber of commerce, and newspapers. Fine lawns and well-furnished homes are not lacking, and the town is equipped with a good water supply and electric light.

Some 27,000,000 acres of the Territory is covered by timber—cedar, hemlock, spruce, and fir. Alaskan cedar is admirable for shipbuilding, cabinet work, and interior finish; it is close-textured, and wonderfully durable under exacting conditions, and its odor is so suggestive of sandalwood that it has been shipped to Japan, made into ornamental boxes and fans, and sold as genuine sandalwood.

Of the fishing industries, that of salmon is of commanding importance; the worth of the annual catch may be roughly placed at $15,000,000. In May, the "China boss" brings to the canneries a horde of Chinese, Japanese, South Americans, and Filipinos. Men, women and little children work at top speed during the canning season, twelve and fourteen hours a day and seven days a week. Fish poisoning is common. Housing conditions are unspeakably bad. In catching salmon, there are

Photos from the American Museum of Natural History

Grave Post, Wrangell

Old Klawack Indians

Tlingit Indian

SCENES AND NATIVES OF ALASKA

no restrictions as to method, and the trap system menaces the life of the industry. The day's catch of one fisherman, during a particularly heavy "run," was 3,000 salmon. Natives are asking for remedial legislation, the enforcement of the laws governing restraint of trade, and the regulation of child labor. Another urgent need of Alaska is more lighthouses along her dangerous coasts.

Alaska is under a Governor appointed by the President for a four-year term. Since 1912 it has had a Legislature of two Houses. The Territory is in the Ninth Circuit of the Supreme Court, with its four judicial divisions at Juneau, Fairbanks, Valdez, and Nome. Each division elects two members for the Senate and four for the House, the Senate thus consisting of eight members and the House of sixteen. One delegate is sent to Congress from the Territory.

Business licenses furnish most of the revenue, which is approximately $1,000,000. In 1909 there were 152 industrial establishments, with a combined capital of $13,000,000, a combined output valued at $11,130,000, and employing 73,479 men.

Education is carried on by means of a hundred schools, enrolling, in 1913, 6,563 children, and costing $350,000 to support. These are maintained partly by the Federal Government and partly by the municipalities.

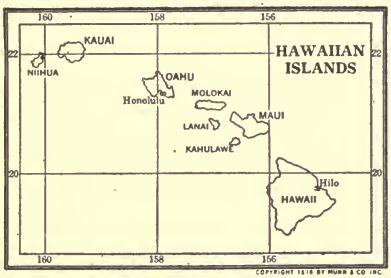
In 1913, 460 miles of railroad were in operation. In 1915, two routes for a most important Government railroad were before President Wilson. One was the Cordova-Fairbanks route; the other was that from Seward, on Resurrection Bay, to Fairbanks, 471 miles inland along the Tanana River. He finally selected the latter route, two reasons probably influencing his choice. First, a railroad from Seward almost to Knik already exists, and was purchasable for the very reasonable sum of $1,150,000; this reduces the length of the new work by some hundred miles. Second, Seward has probably the best harbor and town site in Alaska. The new road will cost $26,000,000, including the construction of a branch from Matanuska Junction to the Matanuska coal field, one of the most valuable fields of high-grade coal in the Territory. The work is under the direction of the Alaskan Engineering Commission, and will later be exended to Yukon, thus opening up the interior and its vast resources.

According to the census of 1910, the population of Alaska was made up of 36,347 white and 28,009 natives, Asiatics, and negroes. The natives are the Eskimo, or Innuit, of the north and northeast, the Tinnehs, or Indians of the interior, the Aleuts, or islanders, and the Tlingits of the North Pacific coast.

HAWAIIAN ISLANDS, 1898

THE cluster of islands constituting the Territory of Hawaii was formerly known as the Sandwich Islands, and is found in the North Pacific Ocean. Hawaii, the largest and most southerly of the group, emerges from the sea about 1,300 miles north of the equator, and 2,200 miles from San Francisco. The discovery of these islands is usually credited to Capt. Cook, in 1778, although an earlier discovery is claimed by Spain. American missionaries were sent there in 1820, and these men reduced the language to written form; soon after this idolatry was abolished by a decree of the ruler, Kamehameha II. In 1844, the independence of the islands was guaranteed by the United States, Great Britain, and France. On August 12th, 1898, the archipelago was transferred to the Government of the United States, and on June 14th, 1900, it was organized as a Territory.

The islands have an area of 6,449 square miles. Although they lie entirely within the tropics, the heat is moderated by the trade winds that blow for nine months of the year; clear skies and an equable temperature characterize the climate and conduce to the healthful conditions which prevail. The temperature at Honolulu, the capital, averages 71 deg. F. in December, and less than 77 deg. F. in July. The rainfall varies greatly, the windward side of the islands receiving the most. At Hilo it may be eighty inches or more, while at the more sheltered Honolulu the average is probably within thirty-eight inches annually. There are no hurricanes of damaging violence, although several high gales may be expected in the course of the winter season.



There are eight islands in the Hawaiian group, besides numerous islets for the most part uninhabited. Hawaii Island, the largest, contains 4,210 square miles, and the population in 1910 was 55,382. Here Mauna Loa, the largest volcano in the world, looms 13,675 feet into the air; Mauna Kea slightly exceeds this height, reaching 13,805 feet, and ranking as the highest peak in the Pacific Ocean. Mauna Loa is still active, and sixteen miles away, in a southerly direction, is Kilauea Hill, which has the distinction of possessing the largest active crater in the world, nine miles in circumference, with vertical sides 1,000 feet in depth. The eastern coast is scarred by ravines reaching a depth of 2,000 feet, through which eighty-five streams pour their waters.

Northeast of Hawaii is Maui Island, of 728 square miles, with a population in 1910 of 28,623. It is mountainous, and presents some picturesque scenery. Its two main portions are connected by a sandy isthmus that is but little above sea level. The summit of Mount Haleakala (10,032 feet) may be reached on horseback; the long, regular gradients make this feat comparatively easy. At the summit is found the largest extinct crater in the world. The northwest coast possesses a good harbor in Lahaina, with steamers plying between that port and Honolulu.

Molokai Island, not much more than a third as large as Maui, is occupied by a low mountain range, and is popularly known as the site of the leper settlement, where all those affected by the disease are isolated.

Oahu Island, with a population of 90,000 and an area of about 500 square miles, presents some of the most charming, natural formations, combining mountains and ravines, cascading waters, and rich foliage and vegetation into pictures wholly satisfying to the artistic eye. Coral reefs girdle its coasts, and on the southern shore is Honolulu, the capital of the Territory, on a plain formed by the upheaval of an old coral reef.

Kauai Island possesses the most fertile soil of any in the group, the advanced decomposition of its lavas showing that volcanic action has been long extinct. It is roughly circular in shape, of an area of 547 square miles, and in 1910 the population was 23,744. Twenty miles to the southwest is the little island of Niihau.

Cook found few animals in the islands. There were dogs, rats and hogs, and a day-flying bat. The only reptile was a small lizard. There are now cattle, sheep and goats, and some deer. More than

fifty species of birds have been found, but the Chinese turtle-dove and the European house-sparrow are the only birds frequenting the towns.

The windward districts are quite heavily forested. Sandalwood is no longer obtainable, but the candle-nut and the screw pine are characteristic of the slopes and valleys, while the cocoanut palm grows freely on the coast. The soil is generally very productive, and in 1910 there were 4,350 farms, covering 2,590,600 acres, the land being valued at $78,000,000; the live stock upon them was worth $4,300,000. The commercial products include coffee, rice, arrowroot, honey, bananas, sisal, wool, hides, skins and tallow, rubber, cotton, and tobacco, but sugar and tropical fruits are the chief exports. On the sugar plantations the growing use of irrigation canals is resulting in increased crops; that of 1914 was 618,000 tons, and the yield is from two to seven tons to the acre, depending upon location. The industrial establishments of the islands numbered, in 1910, 500, with 7,572 employees, and a combined capital of $23,875,000; the material used was valued at $25,629,000, the output at $47,404,000.

Communication facilities are constantly being improved. There is a large and increasing mileage of good roads, and more than 300 miles of railway, 240 miles of it being on the islands of Hawaii and Oahu. In Honolulu almost every house has its telephone; there are 6,000 miles of wire on the five main islands. The best harbors, after that of Honolulu, are Pearl, on Oahu; Hilo, on Hawaii; and Kahului, on Maui. From these and the lesser ports of the group, 436 vessels of a total tonnage of 1,574,845 cleared in 1915, and in the same year 456 vessels, of 1,605,925 tons, entered. Inter-island transportation is provided for by a fleet of sixteen small steamers. At Honolulu new wharves have been constructed, and the largest steamers can now be accommodated. At Hilo and at Kahului breakwaters have been built, and the harbor of Kahului has been deepened. The erection of lighthouses has progressed steadily. Ten steamship lines touch at the islands, from Canada, the United States, the Philippines, China, Japan, and Australia. Wireless puts the islands into communication with each other, with the Pacific coast, and with vessels at sea, and cables stretch to both shores of the Pacific.

Upon formal annexation to the United States, a Legislature of two houses was established. Fifteen members are elected for a four-year term to the Senate, and thirty members with two-year terms constitute the House of Representatives. Once in two years these bodies meet in a sixty-day session. The President of the United States appoints for four years a Governor, at a salary of $7,000, and a Secretary. A Delegate is elected to the United States Congress by popular vote. The judiciary consists of a Supreme Court and Circuit and District Courts; district magistrates are appointed by the Chief Justice of the Supreme Court; all other judges, including those of a United States District Court, are appointed by the President. There were nearly 8,000 convictions in 1915, mostly for minor offenses.

There were 170 public schools in 1915, where 735 teachers gave instruction to 29,000 pupils, at a cost of $772,000; besides this, $70,000 was expended upon new buildings. These are free schools, and English is the language in general use. In addition, there are about fifty private schools, with an enrollment of 7,700 pupils, industrial schools for both boys and girls, a normal school, a College of Agriculture and the Mechanic Arts, and a reformatory. The enrollment records disclose the fact that of all these pupils some 18,000 are Asiatics, 8,000 are of Hawaiian blood, 5,700 are Portuguese, and 1,403 American, the re-

Photos by the American Museum of Natural History

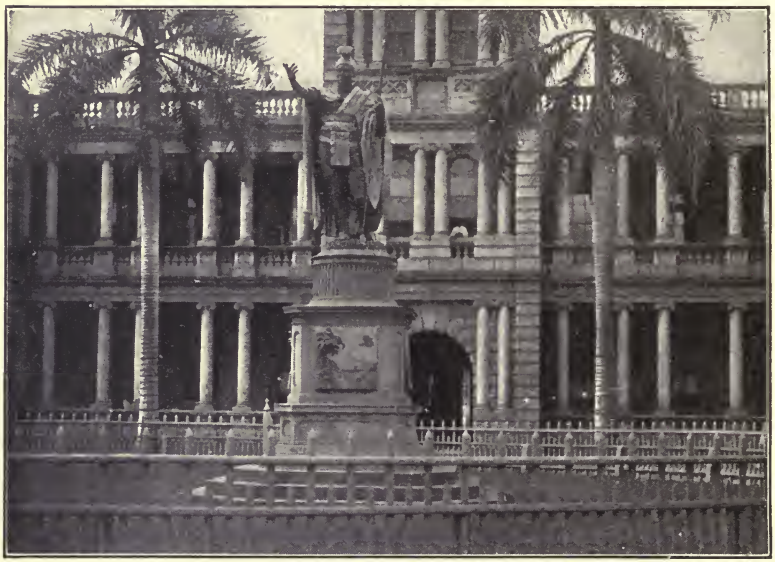
Natives Catching Fish
Objects of Culture

HAWAIIAN ISLANDS

mainder being Germans and British.

In the old days, the Hawaiian was a coast dweller, having his grass hut under the palms, and his garden or small plantation on the hill slopes. A little patch of *kalo*, less than fifty feet square, provided him with a year's sustenance. He was a great fisherman, and there are in existence lines made from fine *olona* fiber which have seen a century of service, and are still in good condition. His huge sailing canoe was a familiar sight to the Melanesians, and the impression made by his gigantic war canoe, carrying its hundred ruddy-skinned warriors, must have been awe-inspiring. This was in the days when the goddess Pele spoke from her volcanic throne, and "Pele's hair," a sort of natural mineral wool spun by the wind from lava-drops, was found in the crevices as substantial evidence of her reality. All this has passed. The Hawaiian of to-day affects European costume; his fishing line, when he condescends to fish, is of cheap foreign manufacture, and much of the fish he eats comes from the tin can; the picturesque hut of grass has been almost wholly replaced by the shack of rude wood, and he is on intimate terms with the slum of the town. When Capt. Cook found him, he was one of a proud race 400,000 strong; to-day that race has dwindled to less than 25,000, if we exclude the 12,000 of mixed blood.

The modern Hawaiian has, however, retained many of the characteristics that make him so attractive to us. He is still a fine specimen of physical humanity, pleasure-loving, athletic, and musical in voice and in temperament. His guitar still holds tones that have never been duplicated upon other instruments or evoked by other fingers. His women continue to weave their flower garlands and bright



GOVERNMENT BUILDING, HONOLULU

necklaces, and the dance has lost none of its abandon.

There are in the islands 80,000 Japanese, 22,000 Chinese, and 22,000 Portuguese, and several thousand Filipinos have been introduced. Japanese, Chinese, and Korean immigration is now forbidden.

The census of 1910 gives the population of Honolulu as 52,183, and the entire population of the inhabited islands is now estimated to be 322,856. Honolulu is in many aspects quite modern; electricity lights its streets and operates its cars. It has a Roman Catholic and an Anglican bishop, and ministers of several other denominations. It has fine parks, a water system, hotels, clubs, newspapers, a hospital, a large library, a museum, and several large manufacturing establishments.

The Hawaiian National Guard is a body of a thousand men, and military works are in progress at various places in Oahu, including fortifications, a naval station, and a drydock at Pearl, on the island of Oahu.

A direct property tax furnishes most of the revenue of the Territory, augmented by licenses and land sales, road, school and poll taxes. The assessed value of all property in 1915 was $176,601,222, the annual receipts from all sources were $2,796,146, and the expenditures $2,747,270; there is a bonded debt of $7,873,000. The exports of the Territory were $62,464,759, the imports $26,416,031, for the year ending June 30th, 1915. Practically all the export trade was with the United States, as was 80 per cent of the import trade. Raw sugar accounted for $51,368,995 of the export figures, refined sugar for $1,584,100, and tropical fruits for $6,319,129.

PHILIPPINE ISLANDS, 1899

IN our East India possessions, the Philippine and Sulu Islands, we have a territory as large as the United Kingdom, with a population larger than that of Canada. To put it more exactly, if less impressively, the area of the archipelago is 121,400 square miles, and the population is 9,000,000. The formation of the group suggests a wish-bone, with the largest and most northerly island, Luzon, as the stem; Mindoro and the long, narrow Palawan, with the chain of islets between them, forms the western fork of the bone; the eastern fork is made up of Samar, Panay, Negros and Mindanao, the latter being the second largest and the most southerly island of the group. The islands and islets number altogether 3,141. The China Sea, which washes the western coasts, puts 500 miles of water between the group and the continent of Asia. The Sulu chain bridges the gap between Mindanao and Borneo, and farther north the gap is again bridged by the long arm of Palawan

and Balabac; these extensions enclose the Sulu Sea; to the south rolls the Celebes Sea, and on the east is the vast extent of the Pacific, the first mainland encountered in this direction being Central America.

The Philippines were discovered by Magellan in 1521. Spain took them by conquest in 1542, and held them for more than three centuries; but on the outbreak of the Spanish-American War, Admiral Dewey, commanding our Pacific fleet, destroyed the Spanish warships in Manila Bay on May 1, 1898, and Manila was taken by General Merritt in the following August. The Mt. Mayon, in Luzon, broke into devastating activity; mild earthquake shocks are frequent, but the buildings are so constructed as to withstand fairly severe shocks. The islands are all mountainous, the general trend of the systems being north and south. Mt. Apo (10,300 feet) on Mindanao is the highest summit; no other peaks exceed 9,000 feet. The longest river is the Cagayan,

LOVELY PHILIPPINE SCENERY

Treaty of Paris (December 10, 1898) ceded the archipelago to the United States. Then followed battles with the native forces under Aguinaldo, ending with his capture in March, 1901.

Of volcanic formation, the Philippines still have twelve active volcanoes. In 1880 destructive earthquakes were experienced; in 1897 which rises in the mountains of the eastern coast of Luzon and traverses the island in a northerly direction for 220 miles; other important streams are the Cotobate and the Agusan in Mindanao. The Laguna de Bay, a fresh water lake, near Manila, is thirty miles long, and numerous smaller lakes are scattered throughout the islands. The archi-

pelago has a longitudinal extent of a thousand miles; from northern Luzon to southern Mindanao is as far as from New York City to southern Florida; hence it is to be expected that climatic conditions vary greatly in different portions of the group. While the climate is, of course, tropical, the heat is on the whole more bearable than that encountered in many temperate countries. The seasons may be designated as hot, wet and cold. The hot season (March to June) is at its worst just before the southerly trade winds begin to blow; in the latter part of this season violent thunderstorms occur; from July and through October the rain falls in torrents, often registering seventy inches for the four months; in Manila, seventy-five inches is perhaps a fair annual average. From November to March is the so-called cold season, when heavier garments are necessary to comfort and a sense of invigoration is born of the cloudless skies and the cleansed air. The mean temperature at Manila is, for the hot season, about 87 degrees; for the wet season, 85 degrees, and for the cold, 72 degrees.

The fauna of the islands is not prodigal in mammals, but it offers peculiarities that well repay the naturalist. There are wild boar and deer; monkeys are found everywhere, one species being a pure white; there is a lemur about the size of a squirrel, which sleeps the day through and seeks its food by night, its long hind-legs propelling it over the ground in frog-like leaps; there are two species of civet, and a wild cat; also porcupines, squirrels and rats, and numerous species of bats; lizards, alligators and turtles are found, and some enormous molluscs; the shell of the tablobo has been known to attain the weight of two hundred pounds. The waters provide both curious and valuable fish. The usual domestic animals are met with, and the buffalo is used in the fields.

The forested area is extensive, and is under the supervision of the United States Forestry Bureau. It offers a wonderful variety of timber, cabinet woods, palms, trees yielding gums, spices and dyewoods, and bamboo. No matter what particular quality or combination of qualities may be sought to meet special uses, a timber may readily be found that will admirably serve the purpose. Since the supply greatly exceeds any local demand that is likely to arise, these forests constitute a most valuable resource. Three-fourths of the trees are of the dipterocarp family, corresponding to the conifers of our zone. From this family may be obtained an abundance of woods eminently suitable for interior finish and for furniture, and exhibiting a wide range of color and texture. Tanguile and red lauan closely resemble mahogany in appearance. If hardness be the quality sought, guipo and apitong may be relied upon; they are extensively used for flooring, and a still harder wood used for this purpose is yacal; this latter is ideal for heavy construction work, as are also ipil and pagatpat; these timbers make strong and durable railroad ties. Should we seek beautiful cabinet woods there are many trees of the locust family, among which may be found colors and grainings to satisfy the most exacting tastes; the ipel is a striking example in this class. Then there are woods that lend themselves to less common and even more difficult demands. Mancono and dungon make the finest dumb-bells, bowling balls and bearings. Calantas is an excellent substitute for the Spanish cedar used in cigar boxes. Ebony, the highest priced of all Philippine woods, has a wide distribution, but the trees do not attain any great size; perfect pieces bring $300 a thousand feet board measure.

The islands are far from poor in minerals. In most of the larger ones gold is found, and the crude workings of the natives have now given

place to an established industry that, in 1913, produced nearly a million dollars' worth of the precious metal. Other minerals found in greater or less quantities are silver, platinum, mercury, lead and manganese; there are several coal fields, iron exists in various parts of the archipelago, copper has long been mined by the natives for manufacture into utensils, and there are evidences of sulphur. petroleum, rock salt, kaolin and gypsum. In 1913 the value of all minerals yielded up by the soil was $1,972,290.

The aborigines were probably Negritos, who were gradually forced into the remoter natural strongholds by their Malayan invaders, until the latter came to dominate the islands. Of the present entire population of 9,000,000 nearly 8,000,000 are Roman Catholics; the Moros are Mohammedans, and number perhaps 300,000; the uncivilized, pagan tribes of the mountains, scattered throughout the islands, make up the remainder. It will be seen that the non-Christian and uncivilized elements can neither singly nor together be taken as in any way representative of the Filipino people. The Malayan is the dominant and representative stock. At the social functions of Manila one meets highly educated men and women in the conventional evening dress. Should we engage one of these men in conversation about his country, he will tell us that writing was common before the arrival of the first Spanish monk, and that the inhabitants were a highly moral people at that time; that they have enjoyed three centuries of civilization; that at the time of the American occupation, 45 per cent of the Christians were literate; that there was a university in the Philippines before Harvard was founded, and that the Americans found on their coming 1,674 public schools, and colleges for both men and women in every capital city of any importance; that Luna had already achieved international fame as an artist, and music and poetry of a high order were written; and that the unusually fine examples of wood-carving demonstrate the artistry of the Filipino craftsman. On the other hand, he would not deny that American occupation had increased the number of public schools to more than 4,000, and had raised the literacy to 75 per cent. There are now 37 educational divisions under direction of the Secretary of Public Instruction, with a public school enrollment of 500,000; there are normal and industrial trade schools, and private

STATUE OF MAGELLAN IN PALACE AT MANILA

schools enroll some 10,000 pupils. The University of the Philippines, maintained by the State, has colleges of Liberal Arts, Law, Medicine and Surgery, Engineering, Fine Arts, Veterinary Medicine and Agriculture, with 2,000 students.

Much thought has been given to the solution of the problem presented by the Moros. With this in view, a hundred miles of More country in

the island of Mindanao has been organized into eight colonies, where the mixed peoples live peacefully together, their children attending the same schools. English is now the official language of the archipelago. The educated Filipino speaks several languages and follows American politics assiduously. The people are in general, kind, hospitable and intelligent.

Agriculture is the chief industry, in which one-half the workers are engaged. More than 8,000,000 acres are under cultivation, 3,000,000 acres being devoted to rice. The principal products are rice, Manila hemp, copra, sugar, maize and tobacco. Obsolete methods and insufficient labor account for the agricultural possibilities being in a neglected state, but our occupation is already accomplishing good results in this direction. All public schools have now an elementary course in agriculture, and a rural credit system is fur-

NATIVES OF JOLO SELLING FRUIT

thered by an Agricultural Bank having twenty-six agencies. In 1914 the outstanding loans of this institution aggregated nearly two millions of dollars.

The 1915 imports amounted to $44,479,861, the exports to $50,915,061. Abaca or Manila hemp stands first on the export list with a value of $19,000,000; copra next with a value of $12,000,000, and sugar third with a value of $9,712,757; cigars and cigarettes accounted for $2,102,317, and all other tobacco for $1,589,678. The value of the chief imports was: Cotton goods, $9,669,247; rice, $5,448,301; steel and iron products, $3,993,984. Half the entire trade of the islands is with the United States.

The central government is vested in a Governor-General, who is also President of the Philippine Commission, assisted by eight commissioners, four of whom are the executive heads of departments known as Interior, Commerce and Police, Finance and Justice, and Public Instruction. The commission constitutes one house of the legislature, the other is known as the Assembly, with eighty-one members elected by limited franchise for four years. Two Resident Commissioners, elected by the Legislature, take their seats, but without a vote, in the United States House of Representatives. Politically, the archipelago is divided into thirty-six provinces and, in addition, the Department of Mindanao and Sulu, which is itself divided into provinces and districts. Thirty-one are known as regular, and the others as special, provinces; the first class are governed by provincial boards elected by the people; governors of the special provinces are appointed by the Governor-General and the commission, acting in concert. Municipal officers are elected for terms of four years by the voters; about nine hundred towns enjoy this autonomy. Each town has a justice of the peace; in each of the twenty-six judicial divisions the administration of justice is under a judge of first instance, with the exception of the city of Manila, which constitutes the ninth district or division, and to which four judges are assigned. There is also a supreme court. Besides the municipal police, there is what is known as the Philippines Constabulary, with a strength of about 350 officers and 5,000 men.

The garrison of the islands has 10,000 American and 5,000 native troops, and a body known as the Philippine scouts number about 5,000.

Customs duties and internal taxes provide most of the revenue, which, in 1914, was $11,912,761; in the same year the expenditures were $13,333,321, but as at the beginning of the year there was a balance of $5,679,587, there was still on hand at its conclusion $4,259,027. In 1914 the bonded debt was $16,125,000. Of the expenditures for this year, more than $5,000,000 was devoted to social and public improvement and economic development.

Leprosy, smallpox, the bubonic plague and cholera were formerly prevalent in the islands. Radical measures have been taken to stamp out these diseases, and much progress has been made. There are between two and three thousand lepers isolated in a colony on the island of Culion. Intestinal diseases, which ravaged the Philippines, have been reduced by almost one-half; this result is attributed largely to the pure water supply secured for Manila; in the smaller towns this has been accomplished by the drilling of hundreds of artesian wells. It is as yet hard to obtain accurate health statistics except for Manila; here the birth rate is about 36, and the death rate 25 or less, per thousand.

Manila has a population of 270,000; of these 17,000 are Chinese; there are probably 6,000 Americans, counting in the garrison, and 6,000 Europeans, two-thirds of them Spaniards. Chinese immigration to the Philippines was prohibited in 1902, and registration is required of Chinese laborers. The number of Chinese now on the islands is put at 50,000, and the entire number of whites (American and European) is estimated to be 20,000. The savage tribes of the mountains differ widely in many respects, and it is a mistake to call them all "Igorrotes." Even the Igorrotes, filthy and barbarous as they are, possess some good traits. Although they live in mountainous parts of the country they cultivate the soil industriously, first terracing the slopes, then laying out their plots upon these terraces, irrigating them by canals that are constructed with no mean skill. They are monogamists among whom divorce is unknown, and by whom infidelity is severely punished.

There is little manufacturing done in the Philippines, but pina fibers, cotton and silk are woven into fabrics that are frequently attractive and durable; baskets, cordage, pottery, furniture, hats, mats, musical instruments and carriages are also made; but the only manufacturing industry of note is that of cigars and cigarettes; 305,000,000 cigars were made on the islands in 1913, about one-third of this output being consumed in the country while the rest was exported; and in the same year 4,500,000,000 cigarettes were produced, mostly for local consumption.

There are more than 5,000 miles of good road in the Philippines, 1,800 miles being hard-surfaced road of the first quality; permanent bridges and culverts number nearly 6,000. At the time of the American occupation in 1898 there were but 120 miles of railway; this connected Manila with Dagupan. There are now 720 miles, with 212 miles more planned, if not actually under construction; 600 miles are on Luzon, 72 on Panay, and 60 on Cebu. The islands have 5,300 miles of telegraph lines and 1,173 miles of cables; 700 post-offices handle the mail. The postal revenue for 1914 was $380,942, and the telegraph revenue was $283,305. Money orders were sold to the value of $8,272,858. The fine harbor at Manila will allow of the entrance of vessels drawing thirty feet of water, and next in importance are the harbors of Cebu and Iloilo. Cebu is a city of 60,000 population, and Iloilo has 50,000. The ports of the Philippines in 1914 received foreign vessels to a tonnage of 1,912,756,

and the tonnage of foreign vessels clearing was 1,931,249. The mercantile marine consists of some 700 vessels, about one-fourth of this fleet being steam vessels, totaling 55,000 tons.

Four banks are established in the Philippines. In 1904, after a troublesome experience with the Mexican dollar, the United States tried the expedient of guaranteeing by gold the Filipino *peso*, a coin worth fifty cents in American money. Fluctuations in value are thus avoided, and the experiment has proved quite successful. The postal savings bank has now about 45,000 depositors, and the total deposits are nearly 3,000,000 *pesos*.

The alertness of the Filipino, and his eagerness to learn, have already been touched upon. It should not, then, surprise us that more than a hundred newspapers are published on Filipino soil. The predominating language of the press is Spanish, but no less than 27 of these newspapers are in English, 33 are in native dialects, and 3 are in Chinese. If further promise of a Filipino renascency is required, we may find it in the quiet tribute of the Hon. John Barrett, director-general of the Pan-American Union, who, in favorably comparing the Philippine Congress with the Japanese Parliament, finds in it "a ministry of bright men, of acknowledged ability as international lawyers."

PHILIPPINE COFFEE PLANTATION

PORTO RICO, 1899

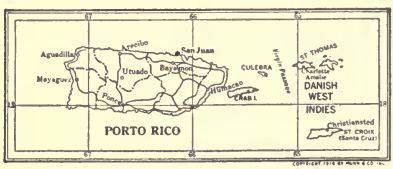
PORTO RICO is the most easterly island of the Greater Antilles, in the West Indies; it was discovered by Columbus in 1493, and was held by Spain until its capture by the United States in 1898. It is 100 miles long and about 40 miles in width, except toward the eastern end, which narrows considerably; the area is 3,436 square miles, and it has, besides, several islands of importance, of which the largest is Vieques (100 square miles). Porto Rico is 1,400 miles from New York and less than 1,000 from Colon, Panama. It is wonderfully fertile and presents a beautiful appearance.

A mountain range, with a maximum height of 3,800 feet, traverses the island from west to east, and there are 1,300 streams, of which fifty may be termed rivers; but none are navigable for more than a mile or two from the coast. The hilly nature of the country causes the trade winds to precipitate their moisture upon the northeastern lowlands, where the average rainfall is 120 inches, while at San Juan, the capital, it is but 55 inches. The temperature varies between 50 degrees and 100 degrees.

Although there are 40,000 small farms, valued in 1910 at more than $102,000,000, and 60 per cent of the workers are on the soil, not much more than one fourth of the land is under cultivation. The lowlands produce sugar, the hill slopes coffee and tobacco; much of the latter, of superior quality, is grown under cloth. Other products are sea island cotton, textile fibers, Indian corn, sweet potatoes, rice, maize, plantains and yams. Grapefruit, oranges, pineapples, cocoanuts and other tropical fruits flourish. Most of the trade is with the United States. The country south of the mountain range is not so well

watered, but for this district there is now under construction an irrigation system, to cost $3,000,000, which will greatly increase the output of the island. Molasses and honey are products of importance, but the staples are sugar and coffee, the former constituting 47 per cent of all exported products. In 1914 320,633 tons of sugar, valued at $20,240,335, and 50,211,947 pounds of coffee, valued at $8,193,544, were shipped from Porto Rico.

Spanish cedar, ebony, rosewood, Indian sandalwood and mahogany are all found on the island, and the *Talauma*, with its white, sweet-scented flowers, furnishes a timber locally known as "sabino." At least twelve different plants are used in dyeing and tanning, and the fruit of the *vijao*, which grows in wild luxuriance, is used by the natives for ink and dyes, which are claimed to be quite fast in color; the root of the turmeric also yields a dye used for hammocks, ribbons and cloth, and this may prove to have commercial possibilities.



Porto Rico is poor in fauna; the passing of the armadillo and the agouti has left only small rodents, squirrels and a species of great land turtle as representative of the four-footed population. Of the few reptiles, none are venomous. Doves and various song birds frequent the higher districts; green parrots abound in the forests; and water birds, among them the gaudy flamingo, are found along the coasts. Both salt-water and fresh-water fish are caught in considerable quantities. Of the domestic animals, cattle are raised in sufficient numbers to form an industry worthy of note.

Little is known of the extent of the mineral resources. Since much alluvial gold was recovered by the Spaniards, it is reasonable to infer that rich veins await discovery in the mountains. Copper, iron, tin, bismuth, mercury, platinum, nickel and coal have been found, and salt is worked extensively. This latter is the only mining enterprise upon an established basis.

San Juan, the capital city, has a good harbor with a fairly clear entrance; when improvements now under way are completed the entrance will be 600 yards wide, with 30 feet of water. The city had in 1910 a population of 50,000, with a town hall, a cathedral, a general hospital and a theater. Other towns are Ponce, which had 63,444 population, and Mayaguez, with a population of 42,429. The island boasts 74 municipalities, each electing its own mayor, city council and city officials.

Porto Rico is administered by a Governor and an Executive Council, appointed by the President for a four year term; six heads of departments and five natives make up the Council. The Legislative Assembly is composed of two bodies, the Executive Council and a House of Delegates; the seven electoral districts each supply five members to the House of Delegates. A Resident Commissioner to the United States is also elected by popular vote for the term of two years; he takes his seat in the Federal Congress. Enactments of the Council and the House are subject to the veto of the Governor. The judiciary of the island includes an Attorney General with his staff, a United States Court, and a Supreme Court of five, all appointed by the President; the Governor appoints fifty-nine justices of the peace; seven District Judges are appointed by the Governor, while the people elect to office the judges and officials of thirty-four municipal courts.

The educational system has been much improved since Americans

took charge of affairs. In 1899 more than 83 per cent of the people could neither read nor write. That year saw the complete reorganization of the school system, education being made compulsory. The number of common schools has been increased from less than 800 to more than 4,300, with an enrollment of 207,010 in 1914. There are four high and twenty-five continuation schools, besides night schools, kindergartens and private schools. At Rio Piedras, a few miles from San Juan, is situated the University of Porto Rico, where students of both sexes receive instruction in such special subjects as teaching, science, engineering, medicine, law, architecture and agriculture; the farm and dairy of the University enable students to master the practice as well as the theory of agriculture, and in this the Government experiment station at Mayaguez offers its wholehearted and valuable co-operation.

In 1892 the island possessed 119 miles of railway. It now has more than 220 miles. This links together the towns of the western coast, partly encircles the island, and to a certain extent opens up the interior. It is intended to extend the present facilities until there is a railroad entirely around the island, and another project is the running of a new line across the island, with many branches and ramifications. There are a thousand miles of tolerable roads in Porto Rico, 600 miles of postal telegraph wire, government owned, forty telegraph stations and 80 post offices. The telephone is also winning its way into business and social demand.

The population was estimated for 1914 at 1,184,489, an increase over 1910 of 66,477. Of this population, less than 50,000 are negroes, some 340,000 are mulattoes, and the rest are whites. Almost nothing is known of the original inhabitants; a few of their stone weapons, implements and images, with some earthenware fragments, have been found, and are now preserved in the Smithsonian Institution; and at Gurabo, on the Rio Grande de Loiza, may be seen a sort of monument roughly hewn in stone and bearing a number of mystifying designs.

The revenues of Porto Rico come from customs and excise, from the tax on property, an inheritance tax

FIRST FLAG RAISING IN PORTO RICO

and various fees and licenses. The receipts from these sources for the year ending July 1st, 1914, were $10,108,708; the property had an assessed value of $179,271,023. The police force numbered about 700 men and the military forces about 600.

The industries of Porto Rico are chiefly concerned with the production of embroideries, drawn work and hats. In 1910 there were 939 industrial establishments: their combined capital was placed at $25,544,385, and their output at $36,749,742. These establishments employed 15,582 work people. The tonnage of American and foreign vessels clearing from Porto Rican ports during the year ending July 1st, 1914, was 1,216,909. The island is a port of call for thirteen steamship lines. In 1914 the imports were valued at $36,406,787 and the exports at $43,102,762. In 1915 the exports to the United States alone reached a value of $43,311,920.

GUAM, 1899

GUAM, the largest and most southerly island of the Ladrone group, the rest of which belongs to Germany, lies in the North Pacific Ocean, nearly 1,500 miles east of the Philippines. It was discovered by Magellan in 1521, was held by Spain from 1688 to 1898, and was captured by the U. S. cruiser "Charleston" during our war with Spain. The island is 29 miles long, from 3 to 10 miles in width, and its area is 210 square miles. The northern part presents the appearance of a large plateau, while the southern portion is hilly, attaining a height of 1,280 feet.

The vegetation is luxuriant, and soil and climate are admirably suited to agriculture, but the laziness of the natives has prevented any extensive development of this pursuit. October to May is the dry season, although rain not infrequently falls. The temperature is even, with August and September the hottest months, the yearly mean temperature being about 81 deg. Fahr. Guam is occasionally visited by devastating typhoons and earthquake shocks are not uncommon. Trade winds moderate the heat and conditions are generally milder than in the Philippines.

The valleys are forestrated with valuable hardwoods. Food fruits are the custard apple and sour sop, the pineapple and the cocoanut; breadfruit and bananas grow freely. The hau produces very strong and durable rope; the leaves of the pandanus are used in braiding hats and mats; the ylang-ylang is well known for the perfume it yields. Among the vegetable products are rice, maize, sugar, cotton, indigo, castor oil and tobacco.

About the only native animals are small rodents, but the roe and the wild goat thrive, as do swine and oxen. There are no venomous snakes and the scorpions and centipedes are not dangerous.

The population of Guam is estimated at 13,000; the inhabitants are for the most part Chamorros with a mixture of Tagal, Malay and Spanish blood, speaking a Malay-Spanish dialect, but English is rapidly gaining ground. The American occupation is raising native standards. The lepers have been segregated, telegraphic communication has been improved, public schools established and a good hospital maintained. There is a Government agricultural experiment station at Agaña, the capital, which has paved streets, sewers and a water system and is connected with Apra, the only safe harbor, by a very good road.

The commandant of the naval station acts as Governor. The island has four administrative districts, each with a commissioner as its executive head. Peonage has been abolished and courts of justice established. The 1914 imports were valued at $160,000 and the exports at $50,000. Guam is a port of transit between the United States and the Philippines and army transports call there at frequent intervals, sometimes monthly.

SAMOAN ISLANDS, 1900

THE Samoan group is found in the South Pacific Ocean, 420 miles northeast of the Fiji Islands; named by Bougainville "Iles des Navigateurs," from the natives' skill in handling their canoes, it still appears on many maps as Navigators' Islands. The whole group numbers thirteen islands, for the most part mere rocky and barren islets. By the Tripartite Treaty of 1899, all those east of 171 deg. long. were turned over to the United States, which has had a naval and coaling station there since 1872. Germany retained possession of that portion of the group lying to the west of this

meridian. The United States possessions comprise Tutuila, with an area of 77 square miles and a population of 7,300; Ofu, Aunua and Olosenga, having together an area of some 25 square miles with about 2,000 population; and Rose Island, uninhabited.

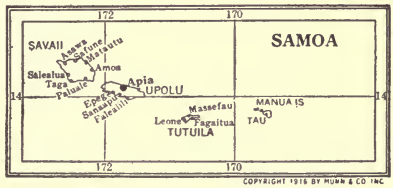
Pagopago, the capital of American Samoa, is on the south coast of Tutuila; its fine harbor almost divides the island into two parts. Tutuila is the best island of the entire group, of a mountainous character, but possessing extensive forests.

The natives of the archipelago are forbidden to sell land to the whites, but are permitted to retain their own laws and customs in so far as these do not conflict with the laws and ordinances established by the Governor, who is also the naval commandant. He is authorized to appoint officers, regulate the police and make ordinances dealing with such matters as the assessment of taxes and the importation of spirits. A body of seventy-five men, under a drill sergeant of the United States Navy, constitutes a native guard.

The natives are of fine physique, but are indolent and very independent, and the plantations have to be worked by imported labor. Hookworm and the yaws are prevalent, but a great deal has been done toward the amelioration of these diseases, and much attention is paid to sanitation and the public health.

There are four religious missions, with numerous sectarian schools; besides these, there is one government supported school and another largely maintained by the native population. The total number of schools is 83, with 2,000 pupils of both sexes.

The political divisions are three—the Eastern, comprising eastern Tutuila and Aunua; the Western, which is western Tutuila; and the District of Manua, taking in Tau and its neighboring islets. Each district has its native Governor; under him are the county chiefs, and under them the chiefs of villages. Each village has its own court.

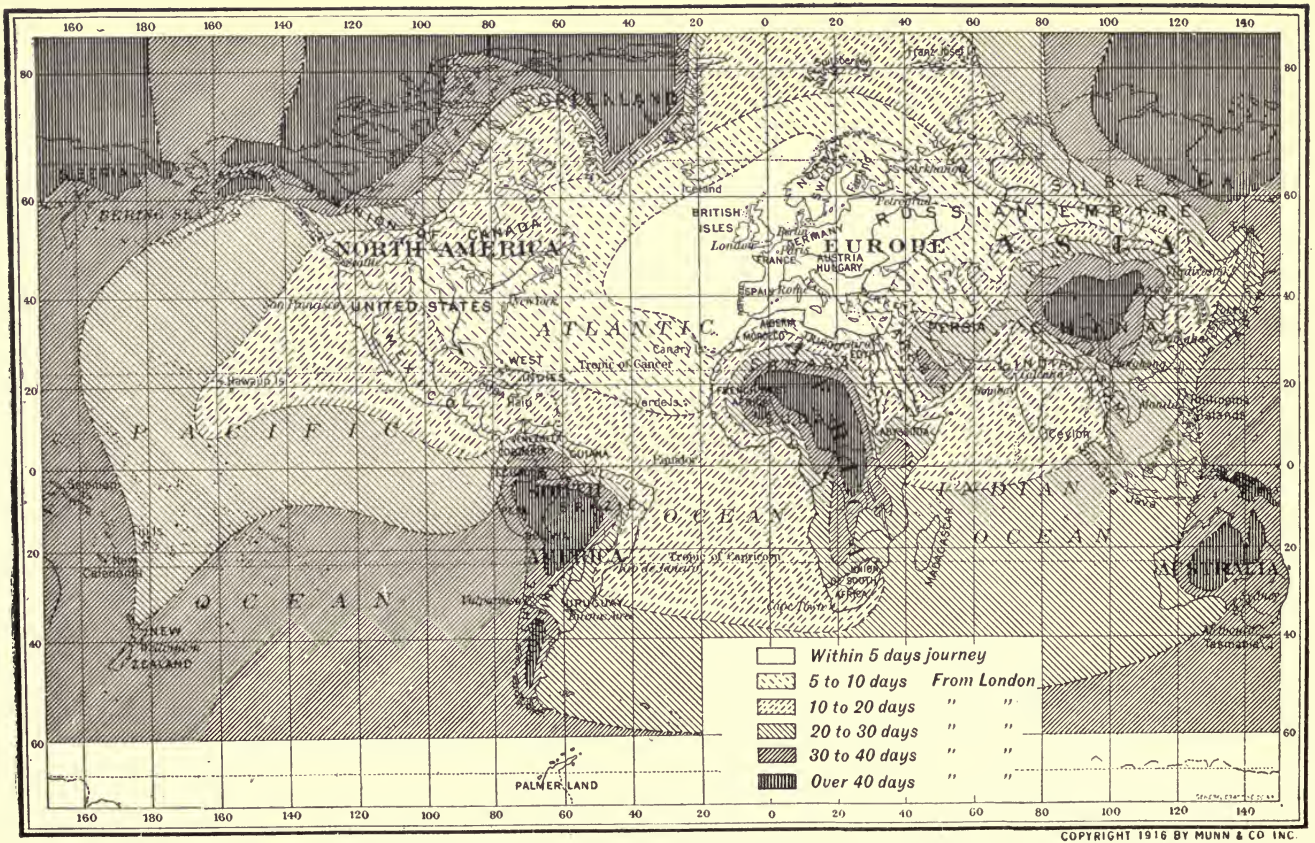


The products of American Samoa include cocoanuts, cocoa beans, bananas, breadfruit, pineapples, oranges, yams and taro, the last being a plant with leaves similar to those of the water-lily, with roots that are baked and used as food. Some cotton, maize, sugar and coffee are raised for local consumption. Copra (dried cocoanuts) and cocoa beans are about the only things exported, the output of copra running to 1,500 tons per annum; this product is largely used as legal payment for taxes.

PANAMA CANAL ZONE, 1904

THE Panama Canal Zone, comprising 436 square miles of territory, was acquired by purchase, February 26, 1904, the sum of $10,000,000 being paid to the Republic of Panama. In addition, Panama is to receive an annual payment of $250,000 during the life of the treaty, beginning nine years after date of ratification.

The Canal Zone begins at a point three marine miles from mean low water mark in each ocean and extends five miles on each side of the center line of the route of the canal. It includes the group of islands in the Bay of Panama, named Perico, Naos, Culebra and Flamenco. The cities of Panama and Colon are excluded from the Zone, but the United States has the right to enforce sanitary ordinances and maintain public order there, in case the Republic of Panama should not be able to do so.



ISOCHRONIC DISTANCES OF THE WORLD

PART II.

OF HUMAN INTEREST TO ALL UNCLE SAM'S PEOPLE

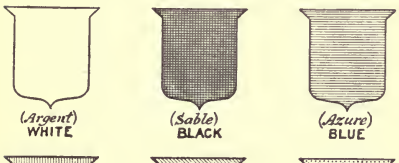
CHAPTER I.

THE AMERICAN FLAG

By ALBERT A. HOPKINS
AND
INSTRUCTOR H. C. WASHBURN
U. S. NAVAL ACADEMY, ANNAPOLIS, MD.

FIRST PART BY THE EDITOR

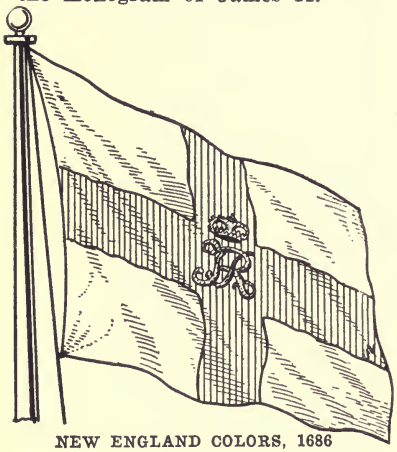
FROM the earliest time the flag has been of prime importance. According to Livy the cavalry flag was a square piece of textile material fixed to the cross bar at the end of a spear. The Roman standards were guarded with the greatest care and veneration, and were kept in the temples of the great cities, and after the advent of Christianity churches received them. All through mediæval and modern history we find the fascinating trail of the standard under various names, which, like the "*Oriflamme*" of France, have come down to us as a valuable heritage.



SHIELDS SHOWING HOW THE HERALDIC COLORS ARE TRANSLATED INTO BLACK AND WHITE

Disregarding the history of flags in general we come to our flag, which is a modern flag in every sense of the word; it has no myths or legends connected with it, and the Heralds' College has never been invoked in its design. Its bright colors are attractive and can be seen long distances, which is not the case with all flags. Love for the flag has been fostered by State, school and church, so that nothing is more venerated in this country than the "Stars and Stripes." Great care has been taken by the Federal and State governments to give the greatest possible protection for the national emblem; thirty-four States have legislation to preserve the American Flag from desecration, mutilation or improper use. The national flag must not be used for advertising, as a cover for a magazine, and the statutes of the United States forbid the use of the flag as a trade mark.

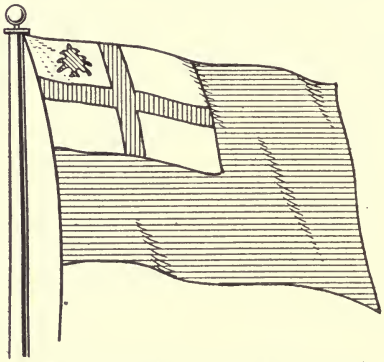
The settlements in the thirteen original States were largely English, and the ceremonial flags of the colonies took the form of the English national standard of the period. In 1643 the colonies of Plymouth, Massachusetts Bay, Connecticut and New Haven formed an alliance called the "United Colonies of New England," and in 1686 they adopted the cross of St. George with a gilt crown over the monogram of James II.



NEW ENGLAND COLORS, 1686

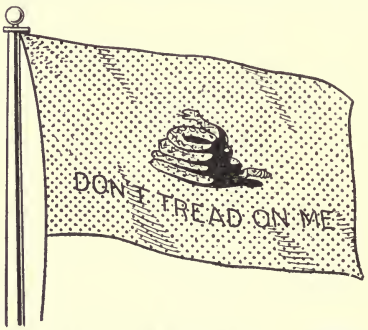
As early as 1700 the colonies began to use flags of their own design, the "pine tree" flag of New England being an example. There are various forms of this flag. In one instance the ground was blue with the cross of St. George in the center and a pine tree in the first quarter. This flag may have been used at the battle of Bunker Hill. Another variation was a flag with a white ground and a green pine tree in the center.

PINE TREE FLAG OF NEW ENGLAND



FLAG USED AT THE BATTLE OF BUNKER HILL (?)

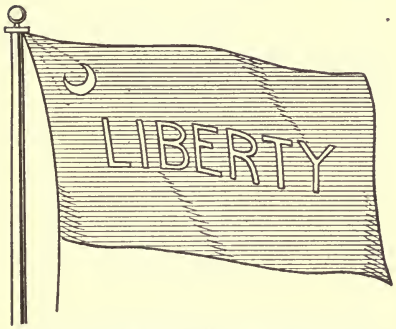
The rattlesnake was another favorite symbol in the Southern colonies, and there are many variations of this flag, but the head of the snake must always face the staff. The motto is usually "Don't tread on me." South Carolina had a yellow flag with the snake on it.



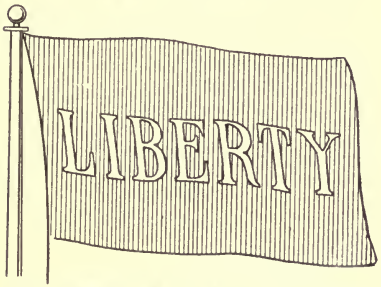
THE RATTLESNAKE FLAG OF SOUTH CAROLINA

An early flag displayed in the South was a dark blue flag with a white crescent, and was raised at Charleston, S. C., on September 13, 1775. The word "Liberty" was a later addition and was used at the

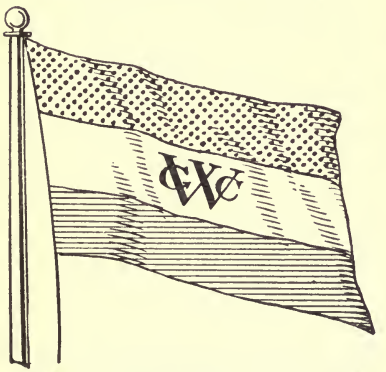
historic defense of Fort Sullivan (now Fort Moultrie), Charleston Harbor, June, 1776.



THE CRESCENT FLAG OF FORT SULLIVAN, CHARLESTON HARBOR, 1776

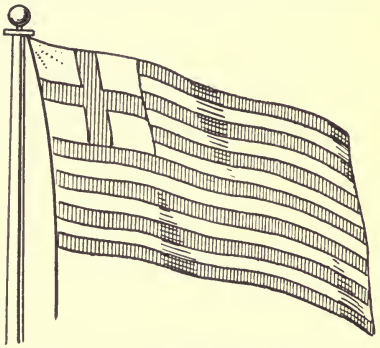


EARLY AMERICAN FLAG OF THE REVOLUTION IN THE SOUTH, CHARLESTON, S. C.
Same as Long Island Battle Flag



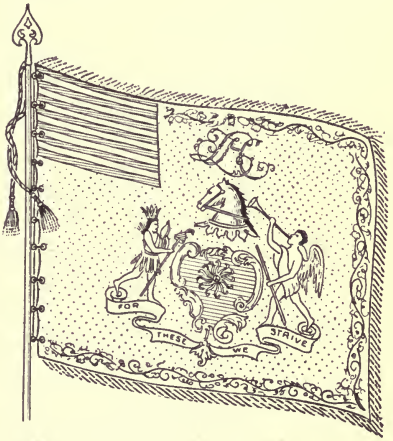
FLAG OF THE DUTCH WEST INDIA COMPANY

These flags, so interesting to students of colonial history, were not, however, strictly speaking, the forerunners of the "Stars and Stripes." The flag, as we have it to-day, is the result of an evolution. The most prominent features of the flag are



FLAG OF THE ENGLISH EAST INDIA COMPANY

the bars. These are not original, however, as we find them in the flag of the Dutch West India Company, and in 1704 the ships of the English East India Company carried flags with thirteen red and white stripes and the cross of St. George in the canton.

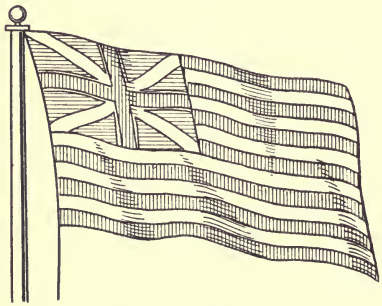


FLAG OF THE PHILADELPHIA TROOP OF LIGHT HORSE, 1775

It has also been suggested that the arms of Washington may have suggested the original form of our flag, but there seems nothing to substantiate it. The first known instance of the use of stripes was in the flag of the Philadelphia Troop of Light Horse, 1775.

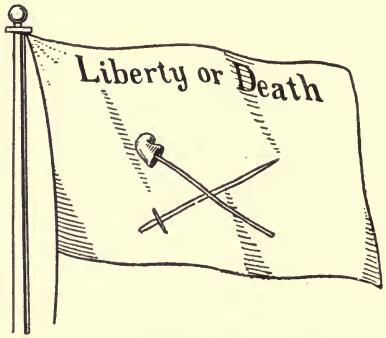
This may have been suggested by the "Cambridge Flag," which Washington raised at Cambridge on January 2, 1776. This was truly the first American flag to show in concrete form the union of the colonies.

There were thirteen alternate stripes of red and white, and in the canton was the combined crosses of St. George and St. Andrew. It is variously called the "Grand Union Flag," the "Great Union Flag," and the "Union Flag." The name "Cam-



CONTINENTAL OR GRAND UNION FLAG
RAISED AT CAMBRIDGE JAN. 2, 1776

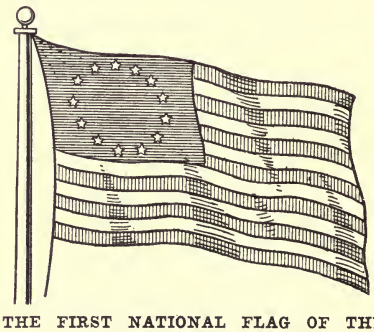
bridge Flag," however, appears to stick, and is eminently appropriate. This flag continued to be used until the Continental Congress adopted the "Stars and Stripes." The so-called "Betsy Ross" flag, or the first "Stars and Stripes," is enmeshed with much romance, but the testimony as to the events rests pretty largely on the statements of Mrs. Ross herself and these are not supported by contemporary writers. Her house still exists at 239 Arch Street, Philadelphia, and is cared for by the American Flag House and Betsy Ross Memorial Association, and is a memorial to the little widowed upholsterer who was the reputed maker of our first flag.



WHITE PLAINS BATTLE FLAG
OCT. 28, 1776

The facts, however, seem to have been these: On June 14, 1777, the American Congress adopted the following resolution:

Resolved, That the flag of the thirteen United States be thirteen stripes, alternate red and white; that the Union be thirteen stars, white on a blue field, representing a new constellation.



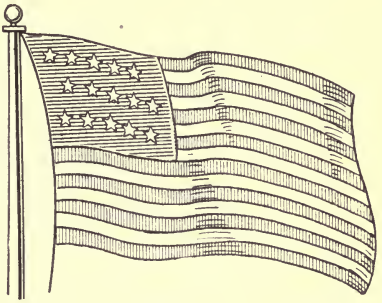
THE FIRST NATIONAL FLAG OF THE
UNITED STATES, ADOPTED
JUNE 14, 1777

John Adams has the credit of proposing the committee that framed the resolution. Washington is said to have remarked, "We take the star from Heaven, the red from our mother country, separating it by white stripes, thus showing that we have separated from her, and the white stripes shall go down to pos-

terity representing liberty." This is pure bombast and is probably apocryphal.

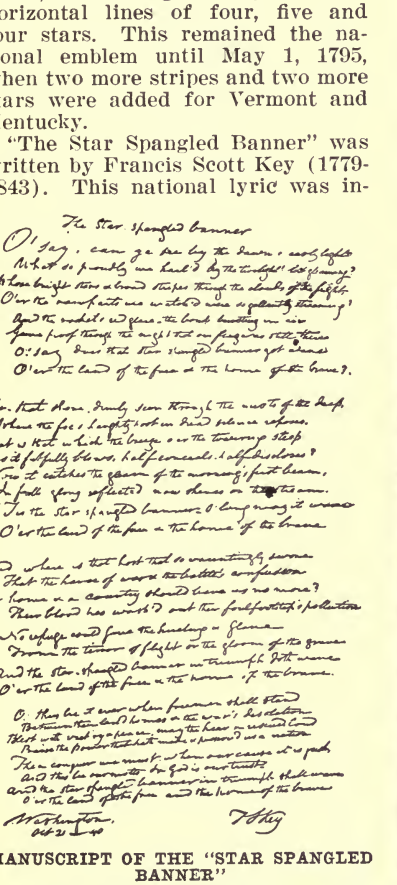
The design was not officially promulgated until September 3, 1777. The stars were first arranged in a circle, but this gave way to three horizontal lines of four, five and four stars. This remained the national emblem until May 1, 1795, when two more stripes and two more stars were added for Vermont and Kentucky.

"The Star Spangled Banner" was written by Francis Scott Key (1779-1843). This national lyric was inspired when he witnessed the bombardment of Fort McHenry, September 13, 1814. He was trying to obtain the release of a friend who had been captured by the British. Key was on this expedition, which had approached under a flag of truce, when he was held temporarily on



THE ORIGINAL STAR SPANGLED BANNER
(Note fifteen stripes)

FIRST PUBLICATION "STAR SPANGLED BANNER"

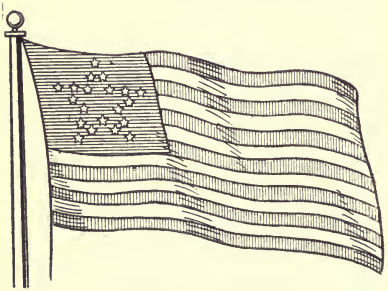


MANUSCRIPT OF THE "STAR SPANGLED BANNER"

From Preble's "History of the Flag of the United States of America." Houghton, Mifflin & Co., Publishers.

his vessel, lest he disclose the intended attack on Baltimore. He was compelled, therefore, to witness the bombardment through the whole day and night, and when he saw the national emblem still floating in the breeze in the morning, his muse compelled him to write this national anthem. The song was first published in the Baltimore American, September 21, 1814. Originally, the song was written on the back of a letter and was copied out in full at night, in a hotel in Baltimore. It was struck off in handbill form and its popularity was widespread. Ferdinand Durang fitted the music of "Anacreon in Heaven" to the words.

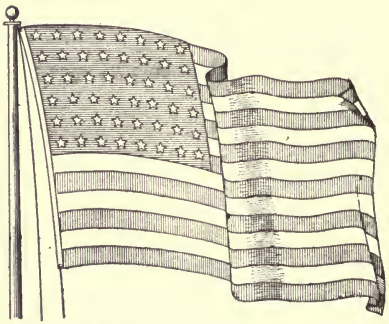
This remained the national flag for twenty-three years. It was used during the war of 1812. By 1818 five additional States were added; Tennessee, Ohio, Louisiana, Indiana and Mississippi were admitted into the Union, so that further changes in the flag were required. The act of April 4, 1818, provided first, "That from and after the fourth day of July, next, the flag of the United States be thirteen horizontal stripes, alternate red and white; that the union have twenty stars, white in a blue field." Second, "That on the



FLAG OF TWENTY STARS AND THIRTEEN STRIPES

admission of every new State into the Union one star be added to the union of the flag; and that such addition shall take effect on the 4th of July, next, succeeding such admission." The return to the thirteen stripes was due not only to a reverence for the flag of the Revolution but also to the fact that a further increase in the number of stripes would have thrown the flag out of balance, or would have made the stripes so thin that they would be indistinct at a distance.

Since this time no change has been made in the flag except to add stars as required. In the war with Mexico the flag had twenty-nine stars in the union, thirty-five during the Civil War, and since July 4, 1912, forty-eight stars. Considerable confusion existed as to the way the stars should be placed. The official arrangement followed by the Army and Navy is as follows:



THE "STARS AND STRIPES" OF TO-DAY

"America" was written by the Rev. S. Francis Smith, D.D. Dr. Lowell Mason, one of the fathers of music in this country, turned over to Dr. Smith some foreign music and asked him if he found anything particularly good to write words for the music. The latter found the tune of "God Save the King," and wrote the remarkable lyric at Andover, Mass., in February, 1832. It was struck out at a sitting with no idea of its future popularity. The first time it was publicly sung was at a children's celebration of American Independence, at the Park Street Church, Boston, July 4, 1832.

America.

My country, 'tis of thee,
Sweet land of liberty,
Of thee I sing:
Land where my fathers died,
Land of the pilgrims' pride,
From every mountain side
Let freedom ring.

My native country, - thee,
Land of the noble free, -
Thy name I love;
I love thy rocks and rills,
Thy woods and templed hills;
My heart with rapture thrills,
Like that above.

Let music swell the breeze,
And ring from all the trees
Sweet freedom's song;
Let mortal tongues awake,
Let all that breathe partake,
Let rocks their silence break, -
The sound prolong.

Our fathers' God, - to Thee,
Author of liberty,
To Thee we sing:
Long may our land be bright
With freedom's holy light;
Protect us by thy might,
Great God, our King.

S. F. Smith.

ORIGINAL MS. OF "AMERICA"
From Preble's "History of the Flag of the United States." Houghton, Mifflin & Co., Publishers.

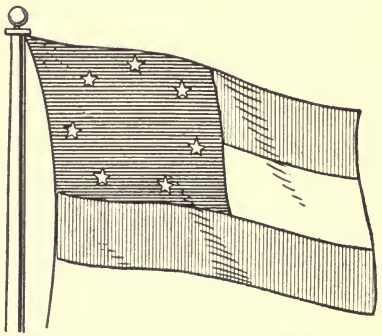
During the Civil War the flag came in for much attention and the stirring words of Secretary Dix may be reproduced herewith:

Treasury Department
Jan. 29, 1861

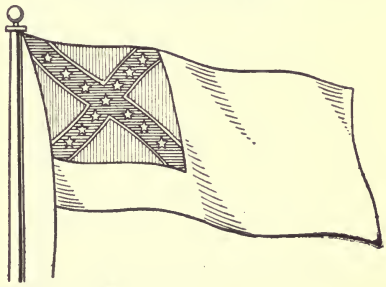
If any one attempts to haul down the American flag, shoot him on the spot. -

John A. Dix
Secretary of the Treasury

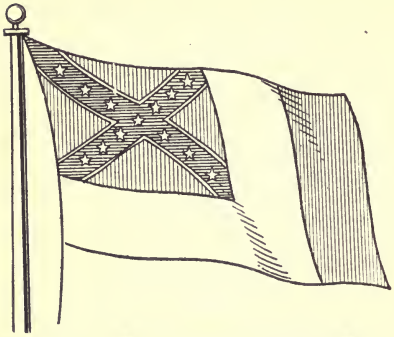
The Confederate flags are of considerable interest. The first was known as the "Stars and Bars." This was adopted at Montgomery, March 4, 1861, the day Abraham Lincoln was inaugurated. It was found that this flag was too much



THE FIRST CONFEDERATE FLAG, THE "STARS AND BARS"



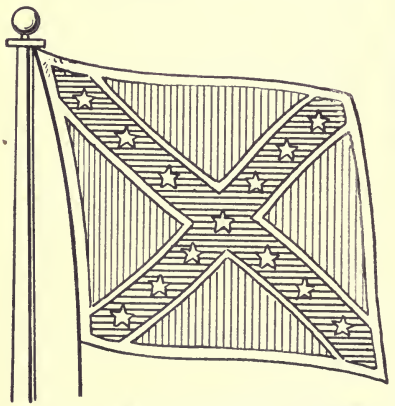
SECOND FLAG OF THE CONFEDERACY



THIRD FLAG OF THE CONFEDERACY

like the flag of the North to be readily distinguished, so a second flag was adopted, May, 1863.

This also was found to be objectionable, having the appearance of a flag of truce, so a broad transverse strip of red was added, so we have the third flag of the Confederacy. This was adopted February 4, 1865. The real battle flag was like the one pictured below.



BATTLE FLAG OF THE CONFEDERACY

Our flag now waves over a united country and over colonial possessions of vast territory and wealth, and has also waved over Morro Castle, when we set the Cubans free, but it did not remain over that historic structure, for we did not invade Cuba with any thought of conquest but to free her from the oppressor.

WHEN AND HOW TO DISPLAY THE FLAG OF THE UNITED STATES

HOLIDAYS

Lincoln Birthday.....February 12th.
Washington's Birthday..February 22nd.
Jefferson Day.....April 17th.
Battle of LexingtonApril 19th.
(Patriots' Day)
*Memorial Day.....May 30th.
Flag Day.....June 14th.
Battle of Bunker Hill..June 17th.
Independence Day.....July 4th.
La Fayette Day.....September 6th.
"Star Spangled Banner" Day (Baltimore) September 13th.
Paul Jones Day.....September 23rd.
Columbus Day.....October 12th.
Battle of Saratoga....October 17th.

UNITED STATES FLAG FLYING OVER MORRO CASTLE, HAVANA, CUBA

Surrender of Yorktown.October 19th.
Evacuation Day (New York) .....November 25th

*On Memorial Day, May 30th, the Flag should fly at half staff from sunrise to noon, and full staff from noon to sunset.

STARS AND STRIPES

is the official name of the national flag of the United States. In the Army our national flag is called the Standard, also the Colors. When borne with another flag, the regimental color, the two flags are called a "Stand of Colors." In the Navy our national flag is known as the United States Ensign.

To show proper respect for the flag the following should be observed:

Photo Harris & Ewing

THE KEY HOUSE, GEORGETOWN

DISPLAY

The flag should not be hoisted before sunrise nor allowed to remain up after sunset.

At "Retreat" sunset, civilian spectators should stand at "attention" and uncover during the playing of the "Star Spangled Banner." Military spectators are required by Regulation to stand at "attention" and give the military salute. During the playing of the National Hymn at "Retreat" the flag should be lowered but not then allowed to touch the ground.

When the flag is flown at half staff as a sign of mourning, it should be hoisted to full staff at the conclusion of the funeral.

In placing the flag at half staff, it should first be hoisted to the top of the staff and then lowered to position, dropping it from the top of the staff the distance of the width of the flag, and preliminary to lowering from half staff, it should first be raised to the top.

On ship board the national flag is the flag to be raised first and lowered last.

Where several flags are displayed on poles with the national flag, the Stars and Stripes should be hoisted first and on the tallest and most conspicuous staff. Where two flags are dislayed, one our National flag, it should be placed on the right. (To ascertain the right of a building, face in the same direction as the building.) No flag should ever be flown from the same staff as the United States flag, except in the Navy; then only during Divine Service, when the Church Pennant may be displayed above the national flag—God above Country.

When, in parade, the national flag is carried with any other flag, it should have the place of honor, at the right. If a number of flags are carried, the national flag should either precede the others or be carried in the center, above the others, on a higher staff.

When flags are used in unveiling a monument, tablet or statue, they should not fall to the ground, but be carried aloft, forming a distinctive feature of the ceremony.

When the national flag is used as a banner the union should be at the right (as you face the flag). When used as an altar covering, the union is at the right (as you face the altar), and nothing should ever be placed upon the flag except the Holy Bible.

The flag should never be flown reversed except in case of distress at sea.

PORTRAYING THE FLAG

To properly illustrate the flag, the staff should always be at the left of the picture with the flag floating to the right. When two flags are crossed, the national flag should be at the right. If the national flag is pictured as a banner, the union is at the right.

SALUTE

When the National colors are passing

THE CHURCH PENNANT ONLY MAY FLY ABOVE THE STARS AND STRIPES

in parade or in review, the spectator should, if walking, halt, and if sitting, arise and stand at "attention" and uncover.

The national salute is one gun for every State.

The international salute is, under the Law of Nations, 21 guns.

On shore the flag should not be dipped by way of salute or compliment.

ORAL FLAG SALUTE

"I pledge allegiance to my flag and to the Republic for which it stands;
One nation, indivisible, with liberty and justice for all."

Trimming the Stars Zig-zagging Striping

MAKING AMERICAN FLAGS

Courtesy of the Int. Film Co.

MRS. VERNON CASTLE AS BETSY ROSS

Part II.

THE TROPHY FLAGS OF THE UNITED STATES NAVY

By Instructor H. C. WASHBURN

U. S. NAVAL ACADEMY

AT the United States Naval Academy, Annapolis, Maryland, is the greatest collection of naval trophy flags in the world. These old flags, one hundred and seventy-two in number, are the priceless symbols of our long honor roll of heroic victories on the high seas, victories won by the consistently maintained skill and efficiency, as well as by the traditional daring and devotion to duty, of our officers and men. Flags of Great Britain, of France, Spain, Mexico and Korea; United States ensigns flown on ships of renown; in one instance

BRITISH ROYAL STANDARD

This gorgeous blazoning of the arms of England, Scotland, and Ireland, together with the arms of the Hanoverian dominions in Brunswick, Lunenburg and Saxony, is said to be "the only British Royal Standard ever captured in battle." And indeed, this great standard, which measures thirty feet by twenty-five, was taken at the attack on York (now Toronto), when that place, then the capital of Upper Canada, was captured by the squadron under Commodore Isaac Chauncey and a land force under General Pike, April 27, 1813. Nevertheless, it should be remembered that the royal standard has for centuries ceased to be a battle flag, that it is used primarily to signify the presence of the sovereign, and that it was found at the Parliament House at York, where it awaited the visit of a member of the royal family. It was in retaliation for Chauncey's raid on York, and more especially, perhaps, for the taking of the Royal Standard from the Parliament House, that the British sent General Ross's army against Washington in 1814, and burned the public buildings at our capital.

the Stars and Stripes side by side with the Stars and Bars of the Confederacy; their age, their faded colors, and the security of their repose as they hang in draped folds of the nation has been maintained by a navy whose traditions are imperishable.

Since 1847, the gradually increasing collection of trophies has been

THE BATTLE FLAG OF LAKE ERIE

In the Flag Room at Annapolis, whose high ceiling and walls are ablaze with captured trophies, the place of honor is assigned to the "DON'T GIVE UP THE SHIP" flag; its message and its story are woven through the threadbare strands of every flag in the collection. This battle flag of the squadron under Master Commandant Oliver Hazard Perry, and his signal for going into action, was flown successively on his flagships the "Lawrence" and the "Niagara," at the battle of Lake Erie, September 10, 1813. Made at Erie by Perry's order, at the suggestion of Purser Samuel Hambleton, it bears on a dark blue field, in white letters rudely fashioned by the hands of jack tars, the dying words of Captain James Lawrence, mortally wounded in the action between the United States frigate "Chesapeake" and the British frigate "Shannon." When the British squadron came in sight of Perry's men, their commander jumped on a gun-slide, and addressed the crew of the flagship: "My brave lads, this flag bears the words of Captain Lawrence. Shall I hoist it?". Wild cheers from their bared throats were echoed from the other ships of the squadron as the bunting was run up to the main-royal masthead. The men took their places at the guns. In the battle that ensued, Perry saved the Great West, and won a complete victory, which enabled him to send his famous message to General Harrison: "We have met the enemy and they are ours—two ships, two brigs, one schooner, and one sloop." The flags of all these vessels are in the Navy Collection, but the commanding position is assigned to this battle flag, with its message: "DON'T GIVE UP THE SHIP!"

behind the glass of their exhibition cases, are significant reminders that we are at peace with those who in the past were enemies, and significant object lessons that the honor kept at the Naval Academy, where, for many years, the flags were exhibited in the old Naval Institute Hall. In 1900, however, when this building was about to be torn down, the

trophies were packed in sealed boxes, to await the day when they should be properly preserved, and placed on exhibition in the new buildings of the Naval Academy, in which alcoves and paneled spaces had been planned for their reception.

It was known that the flags, when packed away, were in poor condition, and it was feared that in spite of all precautions they would be damaged by moths. Efforts to have them put in a permanent state of preservation were, however, unsuccessful, until 1911.

To Commander William Carey Cole, U.S.N., more than to any other individual, but also to Captain John H. Gibbons, U.S.N., then Superintendent of the Naval Academy, who supported Commander Cole in his work, is due the credit for the accomplishment of the restoration of the flags. Early in 1911 Commander Cole, as officer in charge of buildings and grounds at the Naval Academy, began a correspondence which included the naval committees of Congress, patriotic societies, and the custodians of flag collections the world over. In the course of this correspondence, a letter was received from the Hon. Curtis Guild, ex-Governor of Massachusetts, in which Governor Guild named as his choice of an expert on flag preservation Mrs. Amelia Fowler, of Boston. At the request of Commander Cole, Mrs. Fowler examined the flags in April, 1911. She found them so seriously damaged by the ravages of moths, as well as the decay of age, that no ordinary method of preservation would suffice to insure their permanent existence. She accepted the contract for their preservation.

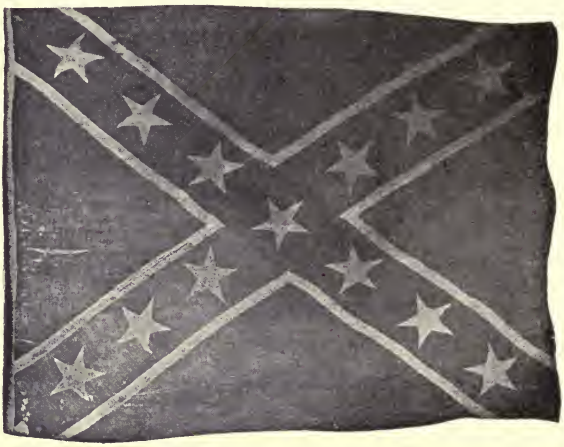
Her special process consisted in spreading the tattered remnants of each flag upon a backing of heavy Irish linen of neutral color. This delicate work was guided by the

JACK OF THE BRITISH FRIGATE "GUERRIERE"

The "Guerrière," Captain James Richard Dacres, was defeated and captured by the famous "Constitution," Captain Isaac Hull, on August 19, 1812, in the first of the frigate actions of our second war with Great Britain. "The sea-spell of England was broken," and although the "Constitution" herself fought two more splendid actions under the command of Bainbridge and Stewart respectively, against the "Java," and against the "Cyane" and the "Levant," the American people have never forgotten the first flush of pride which they felt when they heard the news of Hull's triumph. Among all the single-ship victories won by American naval officers in the War of 1812, the classic of the honor roll is the fight between the ship we have come to love as "Old Ironsides" and His Majesty's ship "Guerriere."

original measurement of the flag, by a knowledge of its design, and by placing in lines at right angles the disarranged strands of the warp and woof threads in the fragments of bunting. What remained of the original flag was then sewn firmly to the linen backing by needlewomen, under Mrs. Fowler's instruction and guidance. The stitches, of silk or linen thread, cover the entire surface of the flag, with circular meshes—a network very strong, yet hardly visible, since the thread is carefully dyed to match the colors of the old flag, however faded or stained in varying degrees. Where there are gaps or missing parts in the original, the stitches, dyed to match the adjacent edges of the old bunting, complete the design of the flag, and tell graphically the story of the pieces that are gone.

On April 8, 1912, Congress passed an act appropriating $30,000 for the work of preservation and preparation for exhibition. Shortly before this act was passed, Commander Cole held up, before the members of the House of Representatives, as an impressive witness, the disintegrating fragments of Oliver Hazard Perry's battle-flag, the signal for going into action at Lake Erie, which bears the dying words of James Lawrence, "Don't Give up



ENSIGN OF THE CONFEDERATE STATES RAM "ALBEMARLE"

This is the only Confederate flag placed on exhibition in the great trophy collection of the United States Navy, and it has been placed side by side with the ensign of the United States sloop-of-war "Kearsarge," to symbolize the Union of the North and the South. The "Albemarle," long the terror of her enemy's wooden vessels, was sunk with a spar torpedo handled from a picket launch by Lieutenant William Barker Cushing, at Plymouth, Roanoke River, North Carolina, on the night of October 27, 1864. Cushing, "the bravest of the brave," whose intrepid deed matches if it does not excel the burning of the "Philadelphia" in the harbor of Tripoli by Stephen Decatur, by this one stroke put an end to the war in North Carolina. His well-nigh miraculous survival enabled him to see this trophy of his exploit, the flag flown on the "Albemarle," which was taken shortly after his exploit, at the capture of Plymouth by the Union army.

the Ship." The sight of this trophy in such a deplorable condition was a final argument for the appropriation to which the House and the Senate could not but respond, and to which they responded with admirable generosity.

On July 12, 1912, Mrs. Fowler's needlewomen, who averaged forty in number began the arduous labor of sewing over by hand every square inch of the flags. Some idea of the magnitude of the task will be had when it is explained that the collection contains no less than 15,000 square yards of bunting. The flags were completely restored, and placed on exhibition with great skill, by May 16, 1913. The work had occupied ten months.

As I have been asked to write an account of the flags for this book on the ground that the honor of cataloguing the collection fell to me, and as some account of the work of cataloguing, which occupied two years, is also requested, it seems proper to state that Commander Cole entrusted to me the work of verifying the identity of all the flags, discovering, if possible, the data concerning certain flags of unknown history, settling questions of the best plan of exhibition, and writing the official inscriptions, or the catalogue proper. When I took up this work, I found confronting me a task difficult in some ways, if not impossible. Evidence was not lacking that a considerable number of the flags had been confused with other flags. To mention a few of these cases—since corrected in every instance—the ensign of the British

ADMIRAL FARRAGUT'S FLAG

This is the last flag hoisted by Admiral David Glasgow Farragut, conqueror of the Mississippi and victor of New Orleans and Mobile Bay. It was flown at the masthead of U.S.S. "Tallapoosa," his last command, and was hung at half-mast during the naval obsequies of George Peabody, at Portland, Maine. Looking up at this flag as a salute was fired at Portsmouth, New Hampshire, in Admiral Farragut's honor, he remarked, "It would be well if I died now, in harness." He died shortly afterward, on August 14, 1870. Until very recently, when Congress established the rank of Admiral, the only officers of our naval service who flew the flag with four stars were Farragut, David Dixon Porter, and George Dewey.

frigate *Cyane* was listed as the ensign of the *Guerrière*, and the jack of the *Guerrière* was listed as the jack of the *Cyane;* there were five other errors in the identity of British flags; even flags captured during the Spanish War had been incorrectly labeled and numbered. The old catalogue, published in 1888, was untrustworthy, and subsequent errors had made it virtually useless. Gradually, by dint of gathering all the evidence available in the form of inscriptions on the hoists of the flags, by eliminating each certainty in identification as it appeared, and by collecting all possible information from individuals who knew certain flags, the problem narrowed down to three or four cases. At last, these were disposed of by the discovery of some old drawings and photographs. In the course of this work. the history of all but two of the flags of unknown history was determined.

ENSIGN OF THE UNITED STATES BATTLESHIP "MAINE"

The battleship "Maine," commanded by Captain Charles Dwight Sigsbee, was blown up while at anchor in the harbor of Havana, Cuba, on the night of February 15, 1898. This flag—its colors intermingled by the action of salt water—was recovered from a locker of the "Maine" after her destruction. It is thought to be the flag lowered at sunset on the evening of February 15, 1898. So far as is known, no poem has been written about the flag of the "Maine" to stir the hearts of Americans. Perhaps there is no need of a poem to summon up the memory of that ship; monuments attest the fame of her gallant dead, and her flag stands among the trophies of the Navy—symbol of the honorable keeping of a nation's word, disclaiming desire for conquest, and of the freedom of Cuba.

CHAPTER II.

AERONAUTICS

By BARON L. D'ORCY, Mem. S. A. E.

Static and Dynamic Aircraft—The Drift Balloon—Captive and Kite Balloons—Dirigible Balloons—History and Mechanics of the Aeroplane—The Development of Military Aviation—Scouting Aeroplanes—Fighting Aeroplanes — Bombing Aeroplanes — The Seaplane — Aeronautics in America

STATIC AND DYNAMIC AIRCRAFT

AERONAUTICS, the science of aerial navigation, and its vehicles, generically termed *aircraft*, subdivide into two distinct branches and types, respectively. The science dealing with machines which are supported by a gas lighter than air, i. e., *static aircraft*, is called *aerostation;* its vehicles are the drift balloon, the kite balloon and the dirigible balloon, all of which, it should be noted, possess the faculty of staying aloft without expending motive power. The science dealing

Photo Hollinger
WILBUR WRIGHT

Photo Hollinger
ORVILLE WRIGHT

with machines which are supported by the pressure onrushing air exerts on cambered surfaces, i. e., *dynamic aircraft*, is called *aviation;* its vehicles are the glider and the aeroplane, of which, however, only the latter possesses practical value, gliders being only used for experimental purposes. Unlike static aircraft the aeroplane cannot remain motionless in the air, for its ability to stay aloft is conditional upon its faculty to create air pressure by continuous motion. This obvious drawback may some day be obviated by the *helicopter* or direct-lift machine, in which sustentation is sought to be attained independently of horizontal motion by the use of vertical lifting screws. This type of machine is still in its experimental stage; such is also the case of of the *ornithopter* or wing-flapping machine, which seeks to copy the movements of the bird's wing-beats, and of the *soaring machine*, which is supposed to fly by the use of favorable air-currents.

THE DRIFT BALLOON

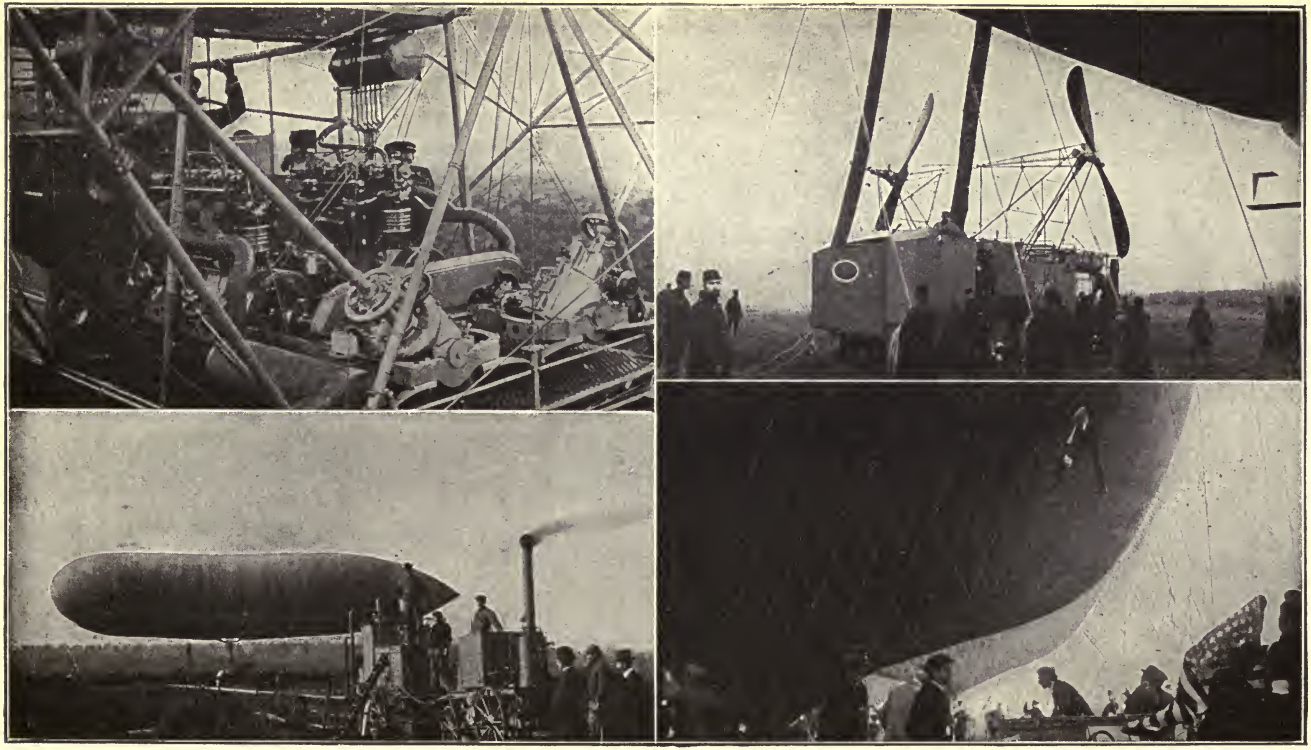
The drift balloon (or aerostat) was invented by the Montgolfier brothers of Annonay, France, who built in 1783 a balloon supported by heated air.

Before the close of the same year the crude hot-air balloon (called *montgolfière*) met a much more scientific rival which shortly succeeded in eliminating it: this was the *charlière*, so named after the physicist *Charles*, who substituted hydrogen for hot air and invented nearly all the fitments of the modern aerostat. Hydrogen gas has a lifting power of about 60 pounds per 1,000 cubic feet and remains the most efficient static motor to the present day; but as its production is expensive, sporting balloons are generally inflated with coal gas, which was invented in 1821 by George Green, of England. Coal gas, however, lifts only about 35 pounds per 1,000 cubic feet.

A modern aerostat consists of an *envelope*, made of varnished silk, calico or rubber-proofed fabric impervious to gas, which is inflated through a long neck on the under side, called *appendix*. The envelope is surrounded with a *net*, the bottom of which is constituted by a *suspension ring* to which the wicker basket carrying the aeronauts is toggled with eight ropes. The top of the envelope is provided with a *valve* which allows part of the gas to escape whenever the aeronaut wishes to descend. Upon landing, the balloon must at once be disinflated in order to avoid being dragged; this is achieved by the *ripping panel*, which covers a vertical seam in the envelope and is operated by a rope whereby the balloon can be torn open instantly.

The equipment of an aerostat comprises: (1) a *guide-rope*, which enables the pilot to maintain his vertical equilibrium, when near the ground, without expending ballast, the balloon being then relieved of part of its weight by the rope trailing on the ground; (2) *ballast*, constituted by sand carried in bags, and (3) various *recording instruments* such as a barograph, a statoscope, a compass, etc.

In the days when self-propelled aircraft were inextant, the drift balloon had a wide usefulness not only in the field of scientific and sporting achievement—where its value remains unimpaired—but also as a vehicle of transportation. This was conclusively demonstrated during the siege of Paris in 1870-71, when the besieged garrison organized a balloon-mail service by means of which 164 voyagers—amongst whom Gambetta—and 3,000,000 despatches were carried over the Prussian lines. Out of sixty-six balloons only five were captured by the enemy and two were lost in the Atlantic; and so great was the moral and material success of this enterprise that Bismarck threatened to shoot every aeronaut as a spy, and Krupp produced the first anti-aircraft gun.



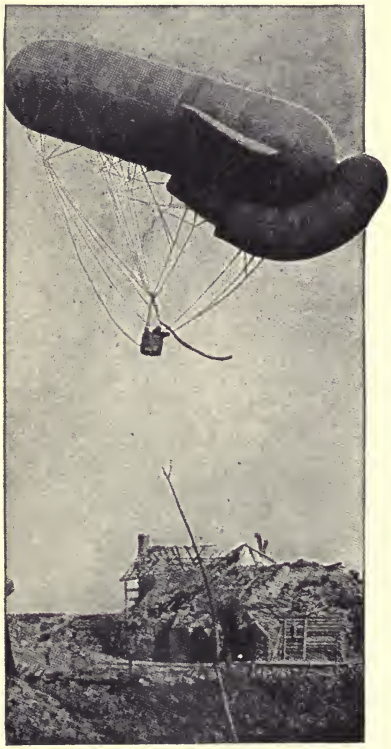
DETAILS OF STATIC AIRCRAFT (DRIFT AND DIRIGIBLE BALLOONS)

In the upper left hand corner, the power plant of a dirigible; *in the lower left hand corner,* inflation with hydrogen of a pressure airship; *in the upper right hand corner,* armored car and propelling mechanism of a French non-rigid airship; *in the lower right hand corner,* close view of envelope, net, basket and ballast bags of an American drift balloon.

Although the dirigible balloon and the aeroplane have now entirely eliminated the drift balloon from military use, it seems certain that the aerostat will always retain its value for scientific and sporting achievements.

CAPTIVE AND KITE BALLOONS

The typical captive balloon is nothing but an aerostat which is maintained at a given height by a cable attached to the ground. Such was the famous *Entreprenant*, which afforded General Jourdan, commanding the French army at the battle of Fleurus (1794), such an excellent view of the enemy's movements, that it actually turned a near French defeat into a brilliant victory. Such was also the gigantic sightseeing balloon Giffard built for the Paris Exhibition of 1878; this craft, which had a volume of 882,500 cubic feet, carried thirty-eight passengers at a time to a height of 1,600 feet, and was hauled down by a 300 horse-power steam winch. This balloon has remained the largest spherical of either drift or captive type.

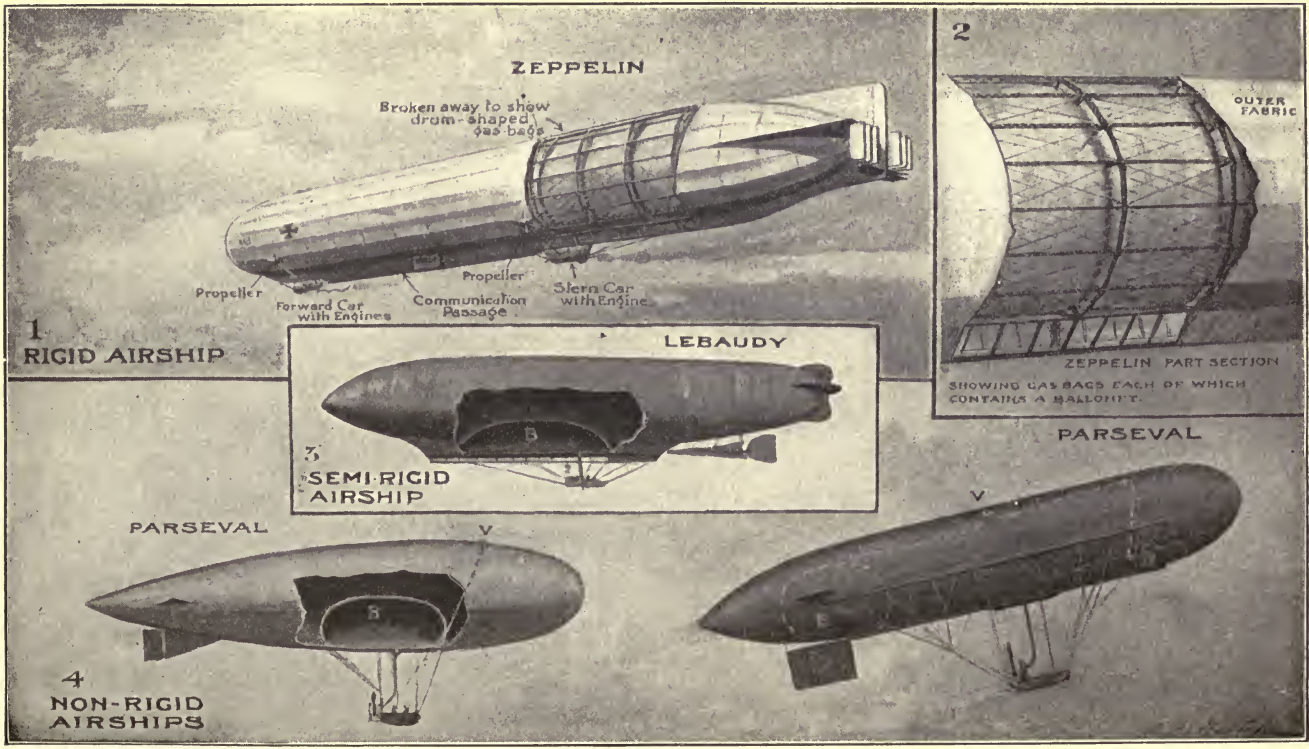


Courtesy of "Flying"
FRENCH KITE-BALLOON ENGAGED IN "GUN-SPOTTING"

Contrary to what might be expected, the lesson of the battle of Fleurus was lost to military science and it was only after the Franco-Prussian war that the military establishments of the principal nations adopted the captive balloon for purposes of observation in field and siege warfare. In this function captive balloons played a certain rôle during French and British colonial expeditions; nevertheless their usefulness proved to be a limited one on account of their inability to stand up in a strong wind.

The defects of the ordinary captive balloon were overcome by two German army officers, Captains Parseval and Sigsfeld, who produced in 1898 the so-called *kite-balloon*—a craft which has proven so successful that it is now recognized to be an indispensable auxiliary of every up-to-date army and navy.

The kite-balloon consists essentially of an elongated gas-bag which is divided into two unequal portions, the larger of which (comprising about four-fifths the total volume) is filled with hydrogen; the remaining one-fifth constitutes the *ballonnet*, or air-cell, and this is automatically inflated by the wind through a convenient aperture. The ballonnet fulfills two purposes: first, it creates within the gas-bag a sur-pressure equal to the pressure of the wind plus the static pressure of the hydrogen, thus enabling the balloon to maintain its shape regardless of any wind the mooring cables can with-



(Courtesy of the *Illustrated London News*)

SCHEMATIC VIEWS OF THE PRINCIPAL AIRSHIP TYPES, SHOWING DETAILS OF DESIGN

stand; and secondly, air being much heavier than hydrogen, the air-cell causes the balloon to assume an inclined position, which is particularly favorable for counter-acting the depressing tendency of the wind. In order to keep the craft always head-on to the wind a sausage-shaped air bag rudder is fitted to the rear of the envelope, which is inflated the same way as the air-cell; longitudinal stability is further insured by a number of sails and a device similar to a kite's tail.

The standard type of kite-balloon has a volume of from 25,000 to 35,000 cubic feet, and it carries one or two observers who are connected by telephone with the artillery unit they are attached to. As a fire-control station for military, and even naval operations of a stationary character (siege, blockade, etc.), the kite-balloon far surpasses the aeroplane, affording, as it does, a steady platform wherefrom field glasses or telescopes can be used to great advantage.

In the Great War the kite-balloon is chiefly being used on the western front, where hundreds of them dot the rears of the Allies' and German lines. Their importance in effectually regulating artillery fire was particularly well demonstrated in the aerial operations which preluded the battle of the Somme. A few days before the big Allied "drive" began, British and French fighting aeroplanes methodically attacked every kite-balloon which stood watch over the German lines in that sector, fifteen being set on fire and destroyed and the remainder being driven down. It was only after the German commanders had been thus deprived of their fire-control stations that the Allied drive started with its bombardment and subsequent infantry attack.

As kite-balloons do not possess any means of defense it becomes necessary to provide their occupants with parachutes so that they might escape with their lives should the balloon be carried away by a storm or be set afire by enemy aviators. Notwithstanding the latter contingency, which incidentally can be neutralized in some measure by the co-operation of anti-aircraft guns and friendly fighting aeroplanes, kite-balloons appear to be decidedly superior to aeroplanes in the function of directing artillery fire because of the former's ability to hover over a place, which aeroplanes do not possess.

DIRIGIBLE BALLOONS

The dirigible balloon is the logical outcome of the Montgolfier brothers' ambition—which prompted their invention—to navigate the atmosphere at will in lieu of drifting slavishly before the prevailing wind.

The basic elements of a dirigible are (1) an elongated gas-container, called *hull* or *envelope*, and so shaped in order to attain the greatest speed with the least expenditure of motive power; (2) one or more *cars* or *nacelles* containing the power-plant which drives a number of propellers, the fuel supply, the crew and the passengers, and eventually a commercial or military load; (3) a system of connection between cars and hull; (4) such means as will assure the permanency of the hull's shape; and (5) such means of control as will effectually regulate the longitudinal and vertical equilibrium.

A century elapsed before all these requirements could be successfully filled. This is why the invention of the dirigible cannot be attributed to one sole man, but is rather due to a series of inventions, such as that of the *ballonnet*, of the *stabilizing fins* and of the *horizontal rudder*, and finally of the *gasoline engine*, which latter has, more than anything else, made the actual success of the dirigible possible.

The existing dirigibles may be divided, according to their mode of construction, into two classes, viz., (1) *pressure airships* in which the permanency of the hull is insured by maintaining within the flexible en-

velope a pressure superior to the atmospheric pressure, and (2) *rigid* or *structure airships*, in which the same object is attained by means of a rigid framework covered with fabric which encloses a number of drum-shaped gas bags. Pressure airships further subdivide into vessels of the

CROSS SECTION OF AN ASTRA-TORRÈS AIRSHIP, SHOWING MODE OF SUSPENSION

non-rigid and *semi-rigid* type, according to whether the car or cars are directly hung from the envelope by means of steel cables or are suspended from a metal keel attached to, or built into, the hull. Of the former type are the Astra-Torrès, the Clément-Bayard, the Parseval and the Zodiac airships; the Crocco-Ricaldoni, the Forlanini, the Gross-Basenach and the Lebaudy dirigibles pertain to the latter. But whatever the mode of suspension, all pressure airships have as a common feature the *ballonnet*, a collapsible air-cell located at the bottom of the hull, which can be inflated with air by a ventilator whenever the gas contracts through a change of temperature or of atmospheric pressure so that a constancy of displacement may be realized. The ballonnet compensates losses of volume, but not ones of lift (air being about fourteen times heavier than hydrogen); a decrease of lift can be made good only by jettisoning ballast (sand or water). An excess of pressure within the hull caused by an expansion of the hydrogen is relieved by automatic valves, which are fitted to both hull and ballonnet; but as the ballonnet valves open at a less pressure than those of the hull an excess of pressure will first be relieved by an expulsion of air from the ballonnet. If, therefore, the latter has a sufficient capacity, no losses of gas will occur in the process of regulating the vertical equilibrium.

On some pressure airships two ballonnets are fitted, one fore and one abaft, which can respectively be pumped full of air and thus steer the vessel up and down by static means; it is more common, however,

AERIAL NAVIGATION CHARTS
(as shown *on the left*) are designed and colored to closely resemble the ground as seen from above (*on the right*)

to effect this function dynamically, i. e., by fitting the airship's stern with a horizontal rudder, called *elevator*, which acts by the virtue of the pressure onrushing air exerts upon an inclined plane. In addition

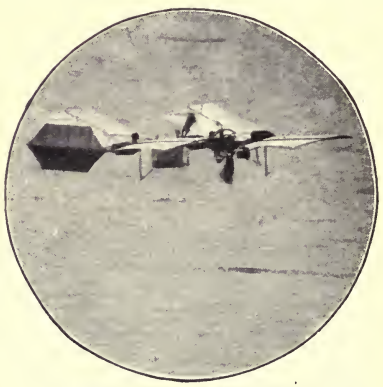
(Photo J. E. Watkins)
OTTO LILIENTHAL'S BIPLANE GLIDER

to an elevator and a vertical rudder, for steering right and left, most airships are fitted with horizontal and vertical *fins*, which serve the purpose of checking any pitching and yawing tendency.

The engines used on airships differ but little from the well known automobile type, except that particular care is taken in their design to obtain the least possible weight and a low fuel consumption; the best airship engines (Chenu, Clément-Bayard, Maybach) do not consume more than one-half pound of fuel per horse-power in one hour. Propulsion is effected by air-screws, which are generally mounted on outriggers on either side of the cars.

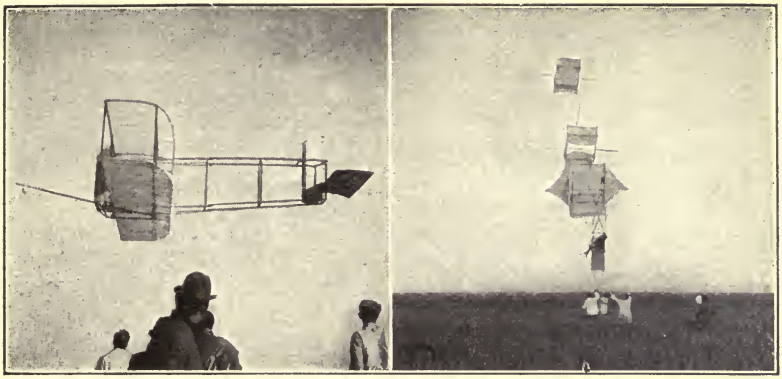
Rigid airships need no ballonnet, the shape of their hull being rendered permanent by the framework. This system has the advantage of being supported by independent gasbags so that if one of these should accidentally become disinflated the airship could still continue its journey. This feature is particularly valuable for military service and it has enabled many a Zeppelin—the most successful rigid airship to date—to escape destruction after having been hit by enemy fire. A remarkable proof of the value of the sectional construction of rigid airships was furnished by a Zeppelin which collided with a tree and had its bow ripped open by the impact; the damage was quickly repaired by taking off three front compartments and by lightening the front car, whereupon the airship concluded its journey, a matter of ninety miles. A similar accident, had it happened to a pressure airship, would have caused the destruction of the vessel.

The great difficulty confronting the operation of Zeppelins is the mooring of these enormous vessels in the open, for unlike pressure airships they cannot be instantly disinflated in case of an impending hurricane; but this drawback, which has caused the loss of a score of Zeppelins, is now being overcome by the increased skill of the airship crews and by a perfected system of anchoring, but



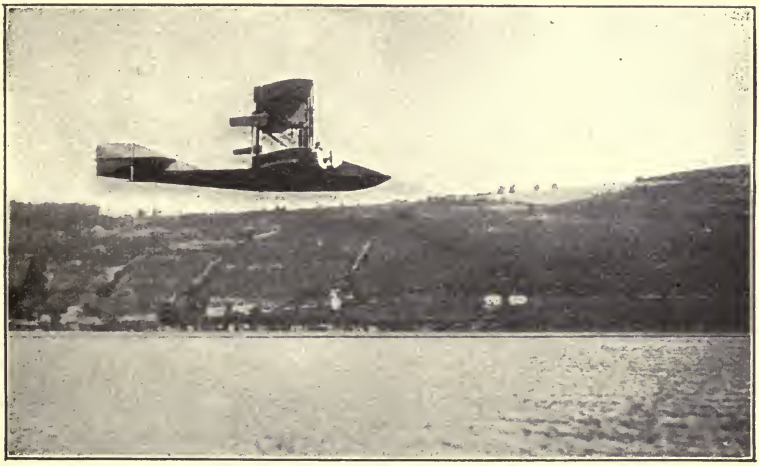
S. P. LANGLEY'S STEAM-DRIVEN AEROPLANE MODEL WHICH FLEW IN 1896 ABOVE THE POTOMAC RIVER A DISTANCE OF ¾ MILE

chiefly by a great number of "airports," which the Germans have fitted with elaborate sheds, hydrogen generating plants, workshops, etc.

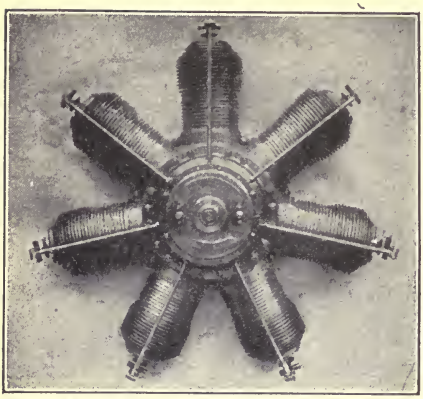


On the left is shown the motorless glider on which O. Wright remained aloft for nine minutes; *on the right*, the man-lifting kite of Capt. Sacconey used for military observation

Before the Zeppelins had become notorious in the Great War as engines of indiscriminate destruction they achieved a more legitimate fame as pleasure craft. For several years previous to 1914 the German Airship Navigation Company of Frankfurt maintained between various German towns a highly successful passenger service in which no passenger ever lost his life, although several accidents marked the operation of the air liners. The Zeppelins engaged in this service were fitted with a luxurious cabin-car, seating twenty-four, and a cold restaurant service was provided. A look-out post fitted on top of the



AN EARLY EXAMPLE OF THE CURTISS "FLYING BOAT"
80 horse-power engine; speed in air, 60 miles an hour; speed on water, 50 to 60 miles an hour



(Photo E. L. Ovington)

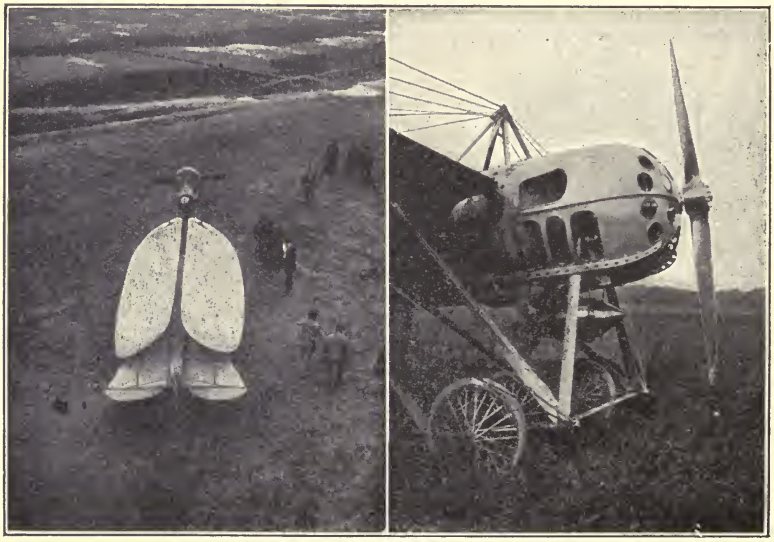
FRONT VIEW OF THE 50 H. P. GNOME ROTARY, AIR-COOLED MOTOR

hull, which could be reached from the bow-car by means of a stairway enclosed in a chimney, enabled the airship commander to navigate by astronomical observation.

While private enterprise thus developed the *air-liner* the German military authorities created the *air-cruiser*—a Zeppelin in which the pleasant cabin-car holds bombs of the explosive and incendiary kind and mounts machine guns, and lately, even small quick-firers for warding off enemy aeroplanes.

Outside of Germany the value of the rigid air-cruiser with its great range and carrying capacity was either overlooked or contested, although in 1912 the first naval Zeppelin covered on its trial run a distance of 1,200 miles in 31 hours, with a crew of 31 and a wireless outfit carrying 200 miles.

When the war broke out the Allies possessed only pressure airships of low range and slow speed, as compared to the dozen Zeppelins Germany was able to line up; this explains the marked superiority in long-range scouting the Germans possessed during the initial onrush on both fronts. The Allies clearly



DETAILS OF AEROPLANE DESIGN

On the left, a machine with folding wings; *on the right,* the armored nose, enclosing a rotary motor, of a military monoplane

perceived their inferiority in this respect and also their inability to produce in a short time rigid airships which would meet the Zeppelins on even terms; so they set upon developing the bombing aeroplane and the anti-aircraft gun. Gradual improvement both in these weapons and in the skill of their operators soon cut short the Zeppelin's value for overland scouting, reducing its activity to night raids on more or less defended towns, which achieved, however, little military damage.

The greatest present asset of the Zeppelin seems to be its faculty to act as a fleet auxiliary for strategic reconnaissance, because it exceeds in this respect not only the radius of action but also the climbing ability of seaplanes. If it be realized that a Zeppelin can see, from a height where it is little vulnerable, four times as far and travel twice as fast as the swiftest scout-cruiser, the extraordinary handicap the British Grand Fleet had to cope with in the battle of Jutland may readily be understood.

Although of much less potentiality than the Zeppelins, the pressure airships of the Allies have been found very useful for anti-submarine defence, mine-sweeping and minor scouting operations. It seems, however, that should the dirigible survive in spite of the aeroplane, which is quite possible, the rigid system will likely prove the ultimate type, there being a limit of size beyond which it will be neither practical nor economic to build pressure airships.

It is interesting to note how rapidly standardized airships can be built in large quantities: since the outbreak of the Great War the three factories of the Zeppelin Company have turned out airships at the rate of one in three, four and five weeks, respectively. By July, 1916, one hundred and ten Zeppelins had been launched, including twenty-five prior to the war; it is true, on the other hand, that up to that date thirteen Zeppelins had been lost in times of peace and forty-two due to the agency of war. Owing to its great vulnerability the military future of the Zeppelin seems rather uncertain; its commercial possibilities, however, appear to be more promising for the immediate future and more especially so for a trans-Atlantic service.

HISTORY AND MECHANICS OF THE AEROPLANE

The aeroplane is—just like the dirigible balloon—not so much one man's invention as the combined product resulting from experiments

(Photo L. d'Orcy)

TWO-SEATER SCOUTING AEROPLANE (160 H. P.) OF THE U. S. ARMY AVIATION SECTION STARTING TO GET OFF

conducted and theories worked out for nearly a century by several schools of investigators. The fundamental theory of the aeroplane was clearly set forth by an Englishman, *Sir George Cayley*, as early as 1809, and actually furnished the basis upon which the modern aeroplane was subsequently built up. In 1846 another Englishman, *Stringfellow*, gave a practical proof of this theory by building a small aeroplane model driven by a steam engine, which made several successful flights under perfect balance; this machine was, in conformity with Cayley's theory, a monoplane. In 1866 *F. S. Wenham*, also of England, invented the multiple surfaced aeroplane and it was again Stringfellow who vindi-

cated the claims of the new principle by a successful free flight of a triplane model. Further important contributions to the dynamics of the aeroplane were made by *A. Pénaud*, *H. Phillips*, *Sir Hiram Maxim* and *S. P. Langley*, late secretary of the Smithsonian Institution. The latter built, in 1903, a man-lifting aeroplane, which, but for its defective launching device, would have flown under control just as it did eleven years afterward with its original rotary motor. The first aeroplane to have actually left the ground, carrying a man, was the bat-shaped machine with which *C. Ader*, of France, made, from 1890 to 1896, several short flights. The balance of this machine, however, was poor, and it was only after the German *O. Lilienthal* had discovered by prolonged gliding experiments the means of controlling the balance of flying machines that progress became practical. Lilienthal's gliding experiments were repeated and perfected in this country, under the guidance of *O. Chanute*, by the *Wright brothers*, of Dayton, Ohio, who gave the aeroplane its one missing link, the warping mechanism for insuring transverse equilibrium; having thus brought the dynamic flyer under three-dimensional control, the Wright brothers fitted their glider with a gasoline engine driving twin propellers and succeeded in making their first power-flights on December 17, 1903, on the beach of Kitty Hawk, N. C. The Wright brothers, therefore, fully deserve the credit of having rendered practical—in other words, invented—the aeroplane.

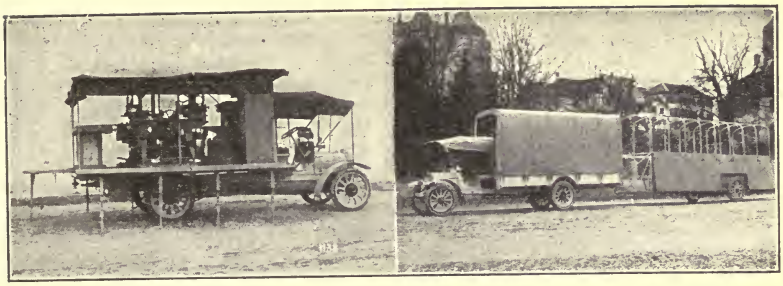
The basic elements of an aeroplane are: (1) the *main surfaces*, or *wings*, of which there are one or more pairs (in the latter case superposed or in tandem) according to whether the machine is a *monoplane* or *multiplane* (biplane, triplane, quadruplane, etc); (2) the *auxiliary surfaces* or *control organs* which regulate the machine's balance and direction (ailerons, fins, elevator and rudder); (3) the *bodywork* or *fuselage*, which forms the bridge between the wings and the tail and affords accommodation for the passengers, the fuel tanks, the navigating instruments, etc.; (4) the *power-plant*, composed of one or more engines actuating one or more propellers, whose position ahead or abaft of the wings causes the aeroplane to be called a *tractor* or *pusher;* and (5) the *undercarriage*, which is fitted with either wheels or floats, or both, for starting from and alighting on land or water, or both.

The *seaplane* or marine aeroplane is the invention of *Henri Fabre*, of Marseilles, France, who made the first flight from the sea on May 21, 1910, at Martigues. The "flying boat," whose development is chiefly due to *Glenn H. Curtiss* and *M. Denhaut*, is a seaplane in which the bodywork is combined with a central boat of large flotation, thus doing away with a special undercarriage.

(Photo L. d'Orcy)

AMERICAN-BUILT SPEED SCOUT FITTED WITH A 100 H. P. STATIONARY CURTISS MOTOR. HORIZONTAL SPEED, 119 MILES PER HOUR.

Particular credit for having advanced the mechanics of the aeroplane is due to *Louis Blériot*, *E. Nieuport*, *J. Béchereau* and *R. Saulnier* (monoplane construction); to the *Voisin* and *Farman brothers* (development of the pusher biplane) to *Louis Brêguet* and *A. V. Roe*, the



THE ROLLING STOCK OF AN AEROPLANE SQUADRON
On the left, a motor repair lorry; *on the right,* an aeroplane truck with its trailer

originators of the tractor biplane, and to *Gustave Eiffel*, whose aerodynamic research work has placed the aeroplane on a scientific basis. No less credit should go to the *Séguin brothers* for their invention of the *Gnôme* motor, which has probably furthered the progress of aviation more than any other single invention and still appears as the prototype of the most promising aeroplane engine; and to *L. Chauvière*, inventor of the wooden airscrew.

Quite an important advance in aeroplane design was achieved in 1913 by a Russian engineer, *M. Sikorski*, who first conceived the idea of building aeroplanes of very large size, driven by several independent motors and capable of carrying a dozen people in a comfortable, heated and lighted cabin. In this country Glenn H. Curtiss has since successfully produced large seaplanes based on a similar principle.

THE DEVELOPMENT OF MILITARY AVIATION

As soon as the aeroplane had proved its ability to effect voyages with sufficient reliability and its range, carrying capacity and climbing ability increased, military authorities all over the world were prompt in adopting it for purposes of reconnaissance. It was in this function that the aeroplane made its *début* in the Great War and the services it rendered were so important that all the belligerents quickly decided upon greatly enlarging their aerial establishments. As specific examples of the work achieved by scouting aeroplanes one might mention how in the battle of Mons the British expeditionary force was saved from envelopment and possible annihilation by an aviator who reported that the Germans had twice the numbers that had been anticipated. Again, at the battle of the Marne it was an aeroplane reconnaissance which disclosed the gap between Von Bülow's and Von Hausen's armies, and thus enabled General Foch to drive a wedge into the German lines, forcing them to retreat.

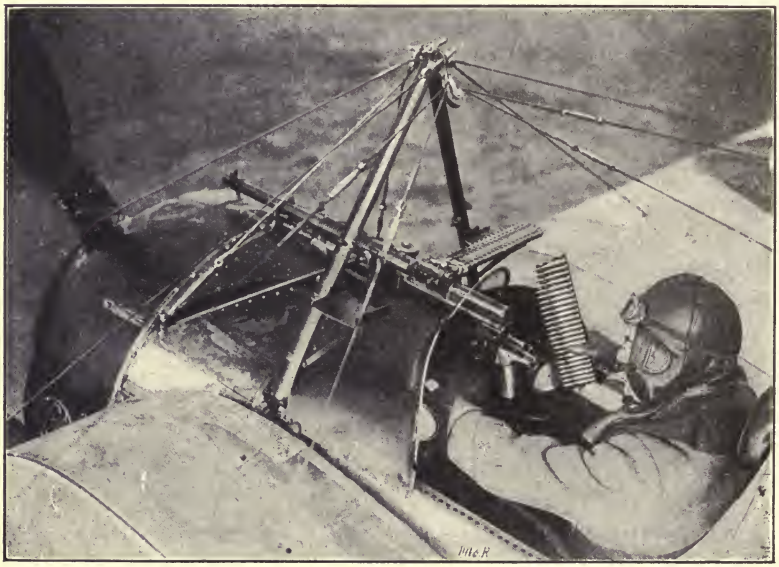
The examples cited sufficiently emphasize the value of the aeroplane for scouting; but as both Allies and Teutons went to war provided with "aerial eyes," each party soon felt the need of preventing the enemy from seeing—and forestalling—the friendly moves. Such was the inception of what is to-day termed a "fighting machine." Then the necessity arose of destroying an important supply station or a railway junction of the enemy, which object could not otherwise be reached than by attacking the place from above: this necessity created the bombing aeroplane.

Originally there were no special machines for the manifold duties

of scouting, fighting and bombing, every aeroplane being supposed to carry out all or any duty as the necessity arose. As a result no aeroplane was really efficient in any function. Curiously enough the Germans still adhere in some measure to this theory which the British and French air services rejected early in the war.

SCOUTING AEROPLANES

The modern scouting aeroplane, as developed by the Allies, is a two-seater of great speed range—else a detailed inspection of the underlying is as a rule a highly trained specialist, who must be able to distinguish from a height of several thousand feet a convoy train from artillery, field guns from howitzers, or a supply station from an aircraft park, and be conversant with the Morse code, so that he may instantly send off his report by wireless telegraphy. To fly back to headquarters would mean too much loss of time. The observer's duty is the more difficult as the enemy below will do everything to mislead him, by setting up dummy guns and holding back his gun fire while the aeroplane hovers



FIXED MACHINE GUN EMPLACEMENT OF A FRENCH FIGHTING AEROPLANE

objective becomes impossible—whose only task consists in observing a given objective and reporting the result in the quickest way possible. Its armament is purely defensive and generally consists of one machine gun firing broadsides and abaft (on tractors) or ahead (on pushers). The crew is composed of a pilot and an observer; the latter above; troop columns on march will stop and seek shelter; positions which cannot be masked will be defended by anti-aircraft guns or possibly by fighting aeroplanes which the observer will have to fight off with his machine gun.

And reconnaissance is not limited to noting the movements and strength of enemy forces; it includes

"gun-spotting," which consists in conveying to the artillery the exact range of an objective to be shelled. These manifold duties of the observer explain why a scouting aeroplane must be a two-seater: the pilot is indeed kept busy enough in trying to keep to his right course while dodging anti-aircraft shells by flying in erratic zigzags.

Although anti-aircraft guns have greatly improved in precision during two years of warfare—of which the monthly lists of the belligerents' aircraft losses bear eloquent testimony—nothing short of a direct hit into a vital part will down an aeroplane, provided its petrol-tank has not been set afire. Shrapnel balls and rifle bullets are little effective against aeroplanes flying at a height of 10,000 feet; a French scouting machine received 400 bullet holes while crossing the enemy lines at only 2,500 feet altitude and still was able to effect a safe return.

The wartime services of an aeroplane may attain a period of three to six months, although a good many machines last but a few weeks; rotary motors last 100 to 150 hours of service, provided they are thoroughly taken apart and cleaned after every 20 hours of service. Stationary engines last a good deal longer.

FRENCH AVION-CANON MOUNTING ONE 1½ IN. Q. F. GUN

The tactical unit of the aviation service is the *squadron*, which consists (in the United States and British armies) of twelve machines of the same type, twelve motor trucks with their trailers for land transportation and of a repair-car, and several automobiles and motorcycles. The squadron subdivides into three companies (flights in the R. Flying Corps) of four machines each.

TABLE SHOWING THE EVOLUTION OF THE ZEPPELIN AIRSHIP

Year	Length (Feet)	Beam (Feet)	Total Lift (Tons)	H. P.	Speed (Miles)
1900	420	38	12.8	32	15
1905	420	38.4	12.9	170	25
1908	446	42.6	17.0	210	28
1910	485	46	21.8	330	35
1912	518	48.5	25.4	600	47
1914	518	54.4	30.5	800	53
1916	780	80	61.0	1,500	65

WORLD'S RECORDS FOR AIRCRAFT

(Those marked * are not recognized by the International Aeronautic Federation)

DISTANCE (Cross Country)

Aeroplanes.....646 miles, by A. Séguin, Paris-Bordeaux-Paris, on Oct. 13th, 1913. (H. Farman pusher, 80 h. p. Gnôme).

Dirigibles.....745 miles* by the Italian Army airship M-2 on Oct. 14th, 1913.

Drift balloons.....1896.97 miles by Berliner, Bitterfeld to Bisserstk, Russia, Feb. 8, 10th, 1914.

DURATION (Non-stop)

Aeroplanes.....21 hrs., 48 min., by W. Landmann, at Johannistal (Germany) on June 26-27th, 1914. (Albatros biplane tractor, 75 h. p. Mercédès.)

Dirigibles.....35 hrs., 20 min., by the "Adjutant-Vincenot" (French army ship), on June 27th, 1914.

Drift balloons.....87 hrs., by Hugo Kaulen, Bitterfeld to Perm (Russia), on Dec. 13-17th, 1913.

SPEED OVER CLOSED CIRCUIT

Aeroplanes.....126.67 miles per hour, by M. Prévost, at Reims (France) on Sept. 29th, 1913. (Deperdussin monoplane, 160 h. p. Gnôme).

Dirigibles.....58 m. p. h.* by the Italian army airship V-1, in Feb., 1915.

ALTITUDE

Aeroplanes.....21,471 ft., by E. Audemars, at Issy, France, on Sept. 8th, 1915. (Morane-Saulnier parasol monoplane, 80 h. p. Le Rhône.)

Dirigibles.....10,728 feet*, by the Italian army airship M-1 in Feb., 1915.

Drift balloons.....34,433 feet, by Suring and Berson at Berlin, on June 31st, 1901.

OVERSEA

320 miles*—St. Gran, from Cruden Bay (Aberdeenshire) to Kleppe near Stavanger (Norway), on July 30th, 1914. Blériot monoplane.

FIGHTING AEROPLANES

Although scouting aeroplanes do carry defensive armament, it often becomes necessary to protect them against a concerted enemy attack. Such is the function of the *fighting aeroplane*, a high-speed, single-seater tractor, which can out-fly and out-climb any other type of machine. The pilot aims the machine-gun, which is rigidly fixed in front of him, by steering the aeroplane against the target; the blades of the air-screw are armored and thus deflect the bullets which hit them. In this way about 30 per cent of the bullets go astray. This gun-mounting, which was invented by R. Garros, the famous French airman, has since been adopted by the Germans on their Fokker monoplanes with the one variance, however, that the gun is connected with a timing device actuated by the motor, so that it can fire only when the blades of the air-screw do not cover the muzzle.

Quick maneuvering ability being one of the chief assets in aerial combat, it follows that fighting aeroplanes must be highly sensitive, in other words, neutrally equilibrated. so as to instantly respond to control; this is why only pilots showing particular aptitude for aerial combat are entrusted with the operation of fighting machines.

In addition to protecting scouting machines, fighting aeroplanes are also used for destroying kite balloons, convoying bombing machines on raids and even attacking Zep-

pelins. Two Zeppelins were thus destroyed from small combat machines carrying but a few bombs, by the late Flight-Sub-Lieut. R. Warneford, R.N.A.S., and Lieut. W. L. Robinson, R.F.C., respectively, whereas aeroplanes of all types, as well as kite balloons, have been lost by the chief belligerents in numbers aggregating several hundreds.

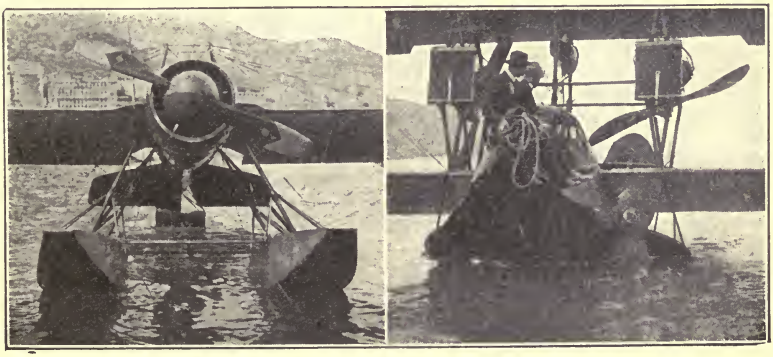
COCKPIT, MOUNTING A MACHINE GUN, OF A BRITISH BOMBING AEROPLANE

BOMBING AEROPLANES

Fighting aeroplanes are but occasionally used as bombers and more especially in cases where quick climbing is imperative. Bombing raids proper are carried out by so-called bombing aeroplanes, in which high speed is forsaken in favor of great carrying capacity. The load of explosives such a machine carries can be apportioned either into a great number of light bombs or else into a few powerful missiles, some of which weigh as much as 300 pounds.

Considering the first two years of aerial operations it appears that the French and the British achieved incontestable aerial supremacy in scouting and fighting only toward the close of this period; it is therefore the more striking that the action of bombing aeroplanes, in other words the aeroplane offensive, should have belonged practically all the time to the Allies. The big bombing raids by French and British aeroplane fleets—some of them composed of fifty and sixty machines—against the airship sheds, railway junctions, shell factories, supply stations, submarine bases and coast defense works of the Germans, in the course of which immeasurable moral and material punishment was inflicted, certainly appear as one of the most striking phases of aerial warfare.

An indication of what the battle aeroplane of to-morrow might be, is furnished by the French *avion-canon;* this is a large pusher, mounting on its bow a 1½-inch quick fire



SEAPLANE UNDER CARRIAGES

On the left, a "twin-floater;" *on the right,* a "flying-boat"

gun, which fires an incendiary shell, and is chiefly used for shooting down kite-balloons.

THE SEAPLANE

The functions of the seaplane are to all intents similar to those of the aeroplane, viz., scouting in advance of fleets and naval bases, clearing the skies of enemy aircraft and bombing the enemy's coast establishments.

Seaplanes work under a double handicap: first, all other elements being equal, their heavy floats greatly decrease the useful load which might otherwise be utilized for increasing their range or their load of bombs, and secondly, the design of seaplane-floats is not yet sufficiently advanced to permit alighting on or starting from a rough sea. Consequently flights of several hundred miles' length, which are common enough over land, are infinitely more difficult to carry out over the sea; this is why all seaplane operations have—unlike the work of land machines—occurred in close proximity of permanent bases or mother-ships.

Notwithstanding their limitations seaplanes have rendered exceedingly useful services as fleet auxiliaries, particularly in the Gallipoli campaign, where gun-spotting seaplanes directed the Allies' guns on targets invisible but from the air. Seaplanes have also played a notable rôle in patrolling the coasts of the warring nations and in detecting and even destroying submarines and mines. And in the battle of Jutland the work of a solitary British seaplane pilot was recommended by Vice-Admiral Beatty in the following terms: "Lieut. F. J. Rutland, R. N., for his gallantry and persistence in flying within close range of four enemy light cruisers, in order to enable accurate information to be obtained and transmitted concerning them. Conditions at the time made low flying necessary."

The present trend in the design of seaplanes (as well as of aeroplanes) appears to be toward machines propelled by several motors and propellers, the purpose of which is to keep the machine aloft or at least capable of returning to its base even if one motor should break down or be destroyed by the enemy.

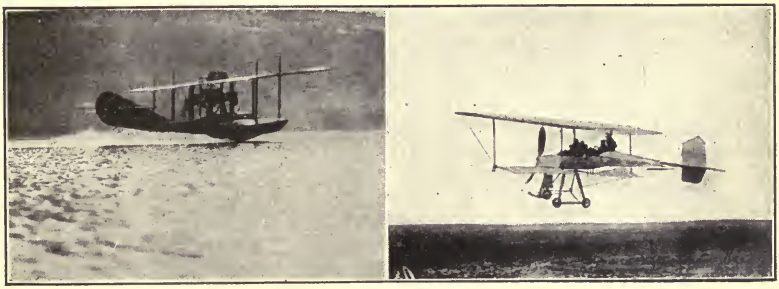
THE SCIENTIFIC AMERICAN TROPHY
donated with the object of fostering the art of aerial navigation, is now in the permanent possession of Mr. Glenn H. Curtiss, who won it three times in succession.

AERONAUTICS IN AMERICA

The Great War has had a very beneficial influence on the American aircraft industry; millions of dollars worth of aeroplanes and motors were

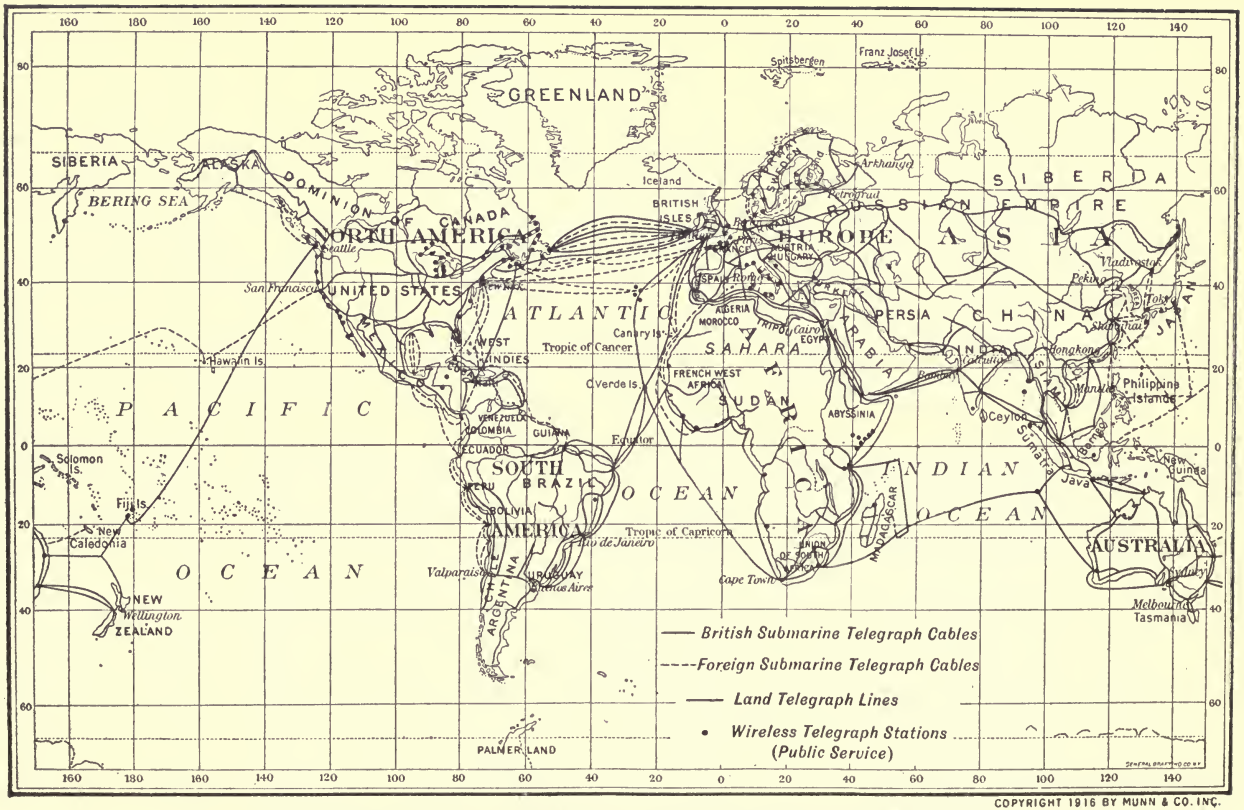
purchased in this country by the Allies, chiefly for training purposes, and the profits derived thereby have enabled American manufacturers to develop aeroplanes and engines which begin to compare favorably with the products of Europe. Among the aeroplanes thus produced one might mention the huge multiple engined "flying boats" of Glenn H. Curtiss; a machine of this type is now being developed for crossing the Atlantic from Newfoundland to Ireland, a distance of 1,800 miles.

The important services the aerial arms have rendered to the warring nations has awakened the American public to the realization that the United States needs—and has so far lacked—an air service adequate to its policies; as a consequence the Aero Club of America instituted the National Aeroplane Fund which, thanks to the generosity of patriotic citizens, has enabled the National Guard of various States to acquire aeroplanes and train aviators, and Congress appropriated a sum of over $15,000,000 for the development of aeronautics in the Navy and Army. On July 13, 1916, President Wilson crowned these measures by creating the Aerial Reserve Corps, which is nothing short of an aerial militia. The Post Office Department is furthermore considering the establishment of several aeroplane-mail routes.



AEROPLANE TYPES

On the left, a flying boat; *on the right,* a tractor biplane



TELEGRAPHIC COMMUNICATIONS OF THE WORLD

CHAPTER III.

WIRELESS TELEGRAPHY AND TELEPHONY

By AUSTIN C. LESCARBOURA

NO list of the greatest modern inventions fails to include wireless telegraphy and telephony. And it is perhaps equally true to state that no invention is regarded with as great awe by the laity. Yet wireless communication in its essentials is simple. There is nothing truly mysterious in wireless or radio telegraphy and telephony.

MILESTONES IN THE DEVELOPMENT OF WIRELESS

The real beginning of wireless communication, or rather the propagation of electric waves through space and their subsequent detection at remote points, is largely a matter of opinion. Some authorities prefer to look upon Steinheil of Munich, Germany, as having taken the first step toward radio communication. For in 1838, Steinheil, following the suggestion of Gauss, demonstrated the feasibility of using the ground as the return circuit for a wire telegraph system, which in a measure is a form of wireless telegraphy in the embryonic state; and what is more, the work of Steinheil caused much attention to be directed to the possibilities of communication without wires. Such names as Trowbridge, Preece, Rathenau, Strecker, Morse, Lindsay, Wilkins, and Melhuish have been associated with the conduction of electric currents through bodies of water and through moist earth, largely through the inspiration offered by Steinheil's pioneer work.

Aside from the conduction method of communication suggested by the experiments of Steinheil, electromagnetic induction between parallel metallic conductors was suggested and studied by Trowbridge, Preece, Lodge and Stevenson. A combination of the conduction and induction principles also was the subject of much experiment, and under the guidance of Sir William Preece, aided by the British Postal Telegraph Engineers, it became the basis of a workable system of wireless communication for short distances. However, for several reasons this system did not lend itself to commercial purposes, and hence nothing came of it. Still another workable system of communication without wires was developed by Edison, Gilliland, Phelps and W. Smith, utilizing the principle of electrostatic induction between conductors spaced some distance apart. The latter system was primarily intended as a means of communication to and from moving railway trains.

However brilliant may have been the conceptions of the various pioneer systems already referred to, the real dawn of commercially practicable wireless communication came with the scientific investigation of electromagnetic waves, resulting in a clear understanding of the generation, propagation, and detection of these waves. Credit in large measure is due Maxwell, who, in 1865, announced his remarkable electromagnetic theory of light. But Max-

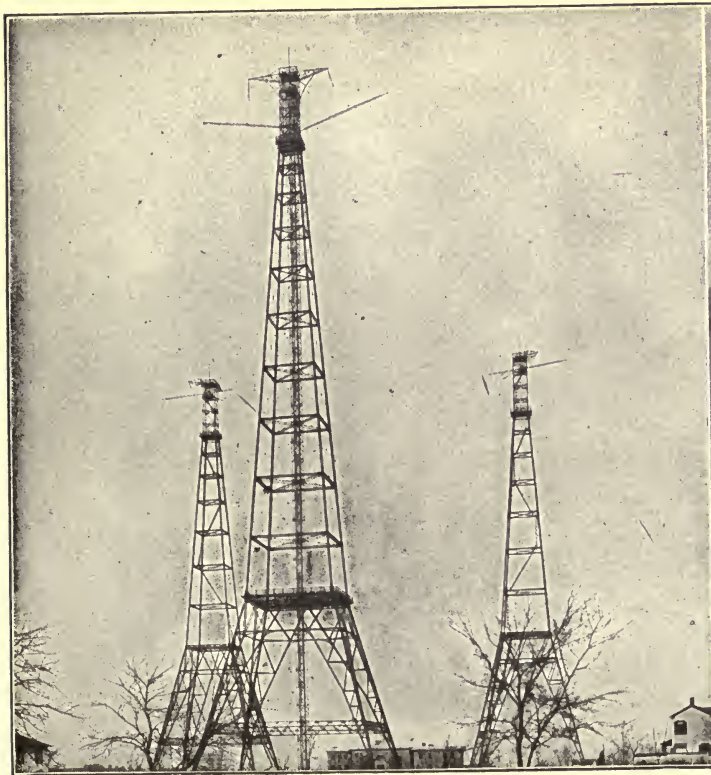
well's work, despite its profundity and its rich and invaluable collection of mathematical data, was primarily theoretical. As a result, its full value as applied to the propagation of electromagnetic waves was not realized until 1888, when Hertz's discoveries and practical investigations again attracted attention to the subject. The work of this young German scientist corroborated the theories of Maxwell; and so rich in possibilities was the field opened by Hertz that numerous scientific workers in various lands set upon the task of acquiring further knowledge of the properties of the electromagnetic waves.

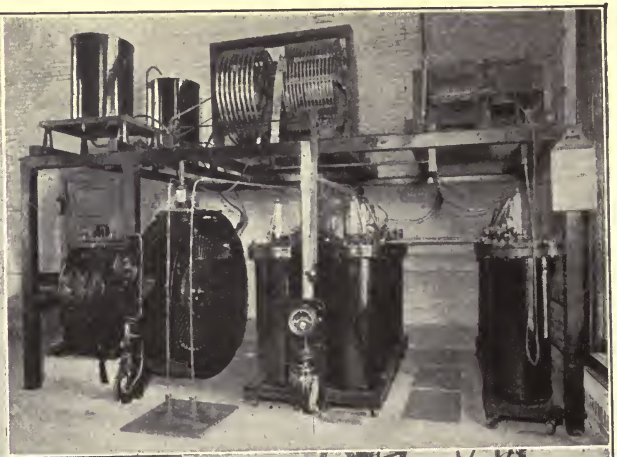
Among the early workers in the field of electromagnetic transmission of power was Nikola Tesla, who, in 1892, conducted a series of spectacular experiments on high frequency electric currents. In passing it must not be forgotten that Prof. D. E. Hughes, according to a paper prepared by Sir William Crookes in 1892, developed a system of transmitting signals a few hundred yards without connecting wires, using a microphonic detector and telephone receiver for the receiving station. It appears that Prof. Hughes discovered the remarkable property of loose-contact filings to cohere under the influence of electromagnetic waves as far back as 1879; but because of the fact that he did not give his work sufficient publicity, some twelve years later Prof. E. Branly of Paris received all the credit for the wireless coherer, which played the leading part in the pioneer days of actual radio communication. Using Branly's coherer as a basis, wireless communication attracted the attention of Dr. A. Muirhead, Capt. H. B. Jackson, R.N., and Prof. R. Threlfall, as well as Prof. A. S. Popoff of the Imperial Torpedo School in Cronstadt, Russia, besides many other lesser known investigators.

Yet all that had been done until this time was more in the nature of laying a substantial foundation for what was to follow. Much of the work was indeed practicable; but none of the investigators had settled down to the development of commercial wireless communication.

Then came Marconi. This young Italian scientist, born at Bologna, was keenly interested in the work of Prof. Rhigi of the University of Bologna, and it gave him the idea for commercial wireless telegraphy. June, 1895, witnessed the young Italian experimenting with sending and receiving apparatus on his father's estate, the Villa Griffone, near Bologna. To relate in detail the ramifications of Marconi's early work would require far more space than can be devoted to this entire wireless chapter, for the work he undertook was slow and painstaking. Although he had the advantages of using various ideas developed by the early investigators and of combining these into a wireless system, each idea by itself was crude and had to be systematically developed. These distances, covered with Marconi's early apparatus, speak volumes for the rate of progress made by him: 1895, 30, 100, and 2,400 meters, or 1½ miles; 1897, 14 miles; 1898, 20 miles; 1899, 85 miles; 1900, well over 100 miles; 1901, transatlantic transmission of the letter "s" in the Morse code, over a distance of 2,200 miles. In the years that followed, the progress made was so rapid that long-distance communication has now become quite commonplace.

Radio telegraphy, as we know it to-day, is not the invention of any one man. Not unlike all other great inventions it represents the labors of numerous investigators and inventors, many known to us and many more unknown to us. Among the better known later-day contributors to wireless telegraphy are Lodge, Muirhead, Salby, von Arco, Braun, Fleming, Fessenden, DeForest, Stone, Shoemaker, Blondel, Artom, Pickard, von Lepel, Poulsen, and Pierce.





Photos by G. V. Buck. From Underwood & Underwood

THE CONNECTING LINK BETWEEN OUR NAVAL VESSELS AND WASHINGTON

At the Left: The three huge aerial-supporting towers of the Government station at Arlington, Va., a short distance from Washington, D. C. Above: A portion of the powerful transmitter of the Arlington station. Below: Arrangement of leads

HOW ELECTROMAGNETIC WAVES TRAVEL THROUGH SPACE

It would be difficult to explain how electromagnetic waves, which are not susceptible to our senses, travel from a wireless transmitter to a receiver at the astounding rate of 186,300 miles per second, were it not for the simple analogy offered by a body of still water.

Suppose a stone is thrown into a quiet pool of water. It will be noticed that waves or ripples form in perfect circles around the spot where the stone struck the surface, spreading out in ever-widening circles from the source. The ripples near the center are big and readily seen, while those some distance away are small and barely discernible, finally disappearing altogether, provided the body of water is sufficiently large. In other words, the ripples are largest near the source of disturbance, but lose their strength in a gradual decrease the farther they are removed from the source.

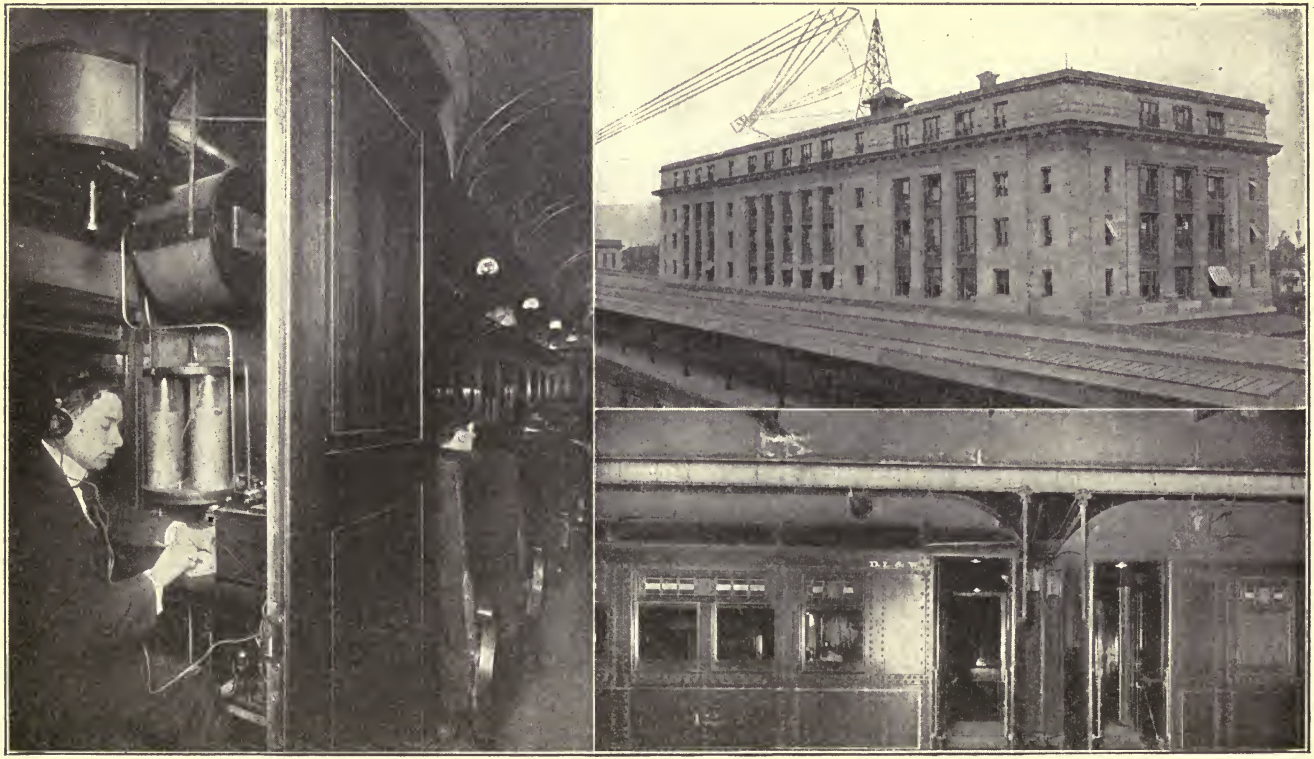
Although according to appearances the waves or ripples appear to form at the spot where the stone hit the surface, spreading out in ever-widening concentric circles, as a matter of fact they form at the immediate point where they appear. There is absolutely no transference of water from the center outward. Instead, a certain amount of mechanical energy is transmitted through the body of water, producing waves or ripples at intervals. The water merely acts as the conductor for the energy imparted to it by the impact with the stone. This may be readily proved by placing a small chip of wood at any spot a short distance from the source of the disturbance: it will be noted that the chip remains in the same spot, although it rises and falls following the up and down or rolling motion of the water upon which it rests. If there were the actual movement of the water from the center outward, the chip, obviously, would move along with the moving water

Much in the same manner do electromagnetic waves react upon space, or, to use the name given to the medium through which these waves are propagated, ether. Nothing actually moves through ether in the transmission of signals by wireless; instead, the transmitting apparatus imparts energy to the ether, which in turn vibrates in much the same manner as the pond of still water. The vibrations spread through the ether in every direction, following the contour of the earth, until the force is spent. Ether, it is well to mention here, is a substance or medium imagined by physicists in order to explain the phenomena of light, radiant heat, and electromagnetic waves. The waves employed in radio communication range from 300 feet to 30,000 feet in length, measured from one crest to the next, just as in the instance of the ripples on a pond. X-rays, on the other hand, have a length of about 2.5 millionths of an inch; actinic rays of the maximum intensity, 10 millionths of an inch; light rays, from 10 to 18 millionths of an inch; and heat rays of maximum intensity, about 15 millionths of an inch.

WIRELESS TRANSMITTERS AND RECEIVERS

For wireless communication it is necessary to have a means of creating and imparting electromagnetic waves to the ether, and a means of intercepting and detecting these same electromagnetic waves at a remote point. The former is called a transmitter, or sender, while the latter is known as the receiver, or receptor.

The most common form of transmitter is one in which the electromagnetic waves, created by the discharge of a condenser across a suitable air gap, are imparted to the ether by means of an elevated system of insulated conductors known as an aerial, and a connection with the earth or ground. The condenser receives its charging current from a transformer or induction coil, and



THE INVASION OF WIRELESS TELEGRAPHY INTO THE RAILROAD WORLD

At the Left: Wireless operator in his booth at one end of a railroad car. Above: Aerial at the Scranton station of the Lackawanna Railroad. Below: Arrangement of aerial on the railroad coaches

whenever it becomes overcharged it discharges an instant later across a gap in circuit with it. Since the length of the wave generated by a spark discharge is governed by two factors, capacity (the measure for the storage capacity of the condenser) and inductance (the length of conductor in the wave-generating circuit), the circuit includes not only the condenser and spark gap, but a variable form of conductor or inductance, as well. The latter is always in the form of a flat spiral, or a helix. The adjustment of the capacity and inductance in the wave-generating circuit is known as tuning, just as a musical instrument is adjusted to emit a note of a desired pitch. By inserting a telegraph key in the primary circuit of the transformer, or induction coil, it becomes possible to generate waves at will; and by the proper manipulation of the telegraph key, an operator can emit different trains of waves to correspond with the dots and dashes of any telegraphic code.

There are other methods of generating electromagnetic waves aside from a condenser charged by a high tension current furnished by transformer, or spark coil. Among them may be mentioned the high frequency alternator, capable of generating current of a frequency of over 50,000 cycles by purely mechanical means. Several generators of high frequency current have been built, and within the past few years considerable progress has been made along this line, despite the seemingly unsurmountable mechanical obstacles encountered at the beginning. A purely mechanical means of creating high frequency current suitable for the electromagnetic waves employed in radio telegraphy and telephony is obviously the most desirable, which accounts for the persistent efforts of inventors along these lines.

Another method of generating high frequency currents is found in the employment of some form of low tension arc, across the terminals of which are shunted a condenser and a variable inductance. With such an arrangement high frequency current is generated, the arc acting as the gap across which discharges the condenser. Whereas in the case of the usual spark transmitters the condenser discharges or electromagnetic waves take place in the form of separate trains, each train or group comprising a number of sparks, each succeeding one less powerful than the one before, in the arc generator the waves are continuous and of the same, uniform strength. Thus the spark transmitters have come to be known as damped wave transmitters because of their damped waves, while the arc transmitters are known as undamped wave transmitters. The damping of the waves lends itself to an analogy in the form of a simple pendulum: In the undamped transmitter, the pendulum would be kept swinging an equal distance each swing, because the power would be imparted so to accomplish this regularity; while in the damped transmitter, the power would be imparted at one swing and not again for several swings, resulting in the pendulum swinging over a lesser arc each succeeding swing until the power were again imparted to the pendulum.

The electromagnetic waves, either of the damped or undamped variety, chopped up in short and long trains to represent the desired characters of any telegraphic code, have now been propagated through ether. The problem is not only to intercept them but also to detect their presence.

The first step in receiving electromagnetic waves is the erection of a suitable system of elevated, insulated wires, known as the aerial or antenna, which serves to intercept the electromagnetic waves, and to lead the currents induced in the wires down through the receiving instruments to the ground.

The heart of any receiving set for wireless telegraphy is that member

TYPICAL WIRELESS APPARATUS OF THE PRESENT DAY

At the Left: A panel type of transmitter employed on some of the battleships of the United States Navy. Above: A Marconi ship station. Below: A wavemeter and a quenched spark gap, both designed by R. Pfund, of New York

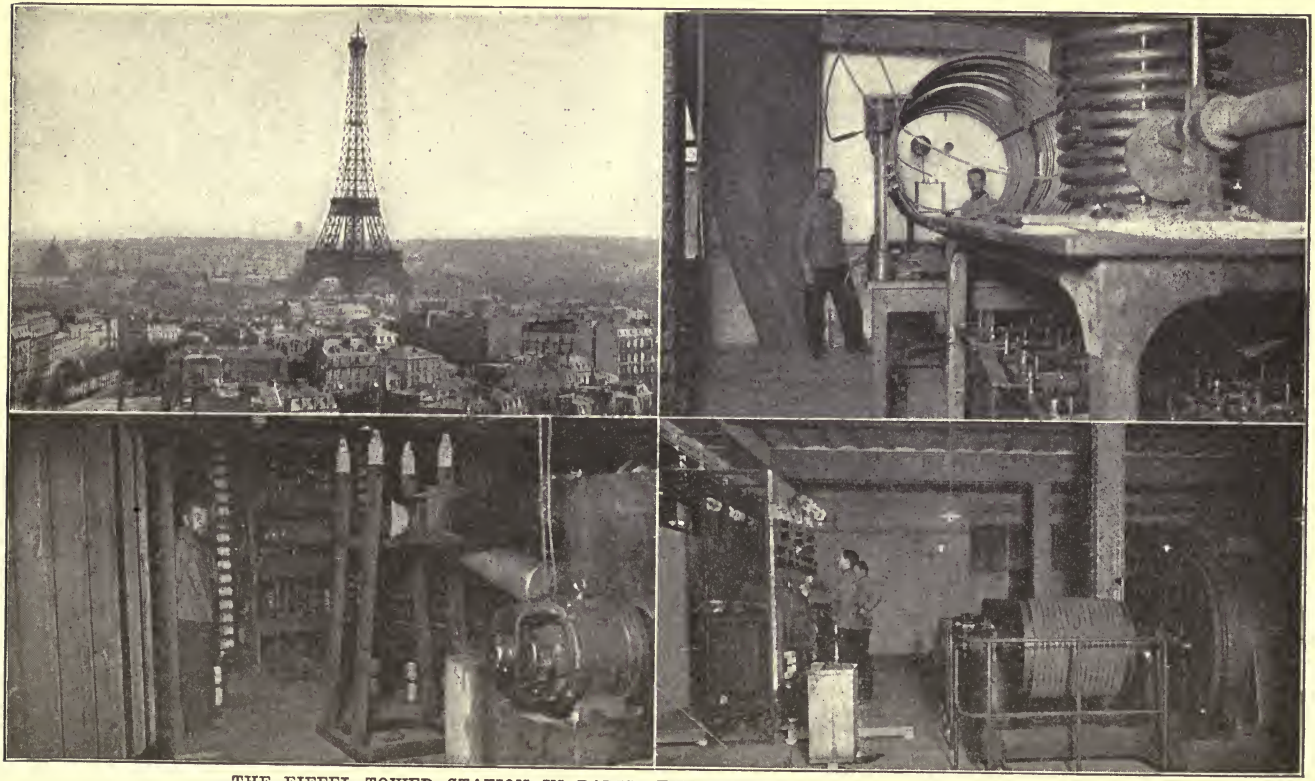
which detects the presence of high frequency currents flowing down through the aerial and receiving apparatus. It is known as the detector. In the pioneer days of the art, a glass tube containing two electrode plugs between which was placed a small quantity of metallic filings, served the purposes of detector. The action of the filings coherer, as this detector is known, is simple: the high frequency current passing through the mass of loose filings possesses the property of causing these to cohere together so as to make a better contact between the two metal plugs. The lowering of the electrical resistance of the filings is sufficient to permit the current of a local battery to flow across the bridge thus formed and operate a relay, which in turn operates a Morse register that prints the signals in the form of dots and dashes on a paper ribbon. Some suitable form of tapper is used to shake the filings apart after the high frequency currents have ceased to flow through them. The tapper, known as the decoherer, is usually operated by the relay.

The filings coherer, while possessing the important advantage of allowing a Morse register to be used in conjunction with it, has long since ceased to be employed in commercial wireless work, although it remains the favorite form of demonstration apparatus for the classroom. It has given way to infinitely more sensitive detectors which are used in conjunction with telephone receivers worn on the head of the wireless operator. With the advent of more sensitive detectors the range of wireless transmitters has jumped from the tens of miles to the hundreds and even thousands of miles.

So numerous and varied are the wireless detectors of to-day that even a superficial description of each type is precluded by space limitations. Suffice it to state that among the most popular types of detectors are the crystal rectifier, utilizing certain minerals and crystal formations such as iron pyrites, zincite, bornite, galena, silicon, carborundum; the electrolytic detector, which, while exceedingly sensitive, has given way to the first type because of the greater convenience of the crystal detectors; the magnetic detector, which would be a truly ideal type were it not for the fact that its sensitiveness is of a rather low order; and the audion, which is the most successful detector and the one in most general use to-day.

Aside from the detector, a wireless receiving set comprises a telephone receiver or receivers, and adjustable condensers and coils for changing the capacity and inductance of the receiving circuit to tune it to any length of wave desired. If a transmitter is emitting waves of a length of 400 meters, for example, a receiving set must be tuned to the neighborhood of 400 meters in order to receive the waves. And while it is tuned to receive those waves, other waves of other wavelengths will not be heard in the receivers of the operator. Thus it is possible for several transmitting sets to be operating in one locality at the same time, while the same number of receiving sets are receiving, each from the desired transmitter, without interference from other transmitters. Tuned or syntonic wireless has reached a high degree of development to-day, although much remains to be accomplished.

After having developed their detectors to the highest possible degree of sensitiveness, wireless men were confronted with the problem of increasing still farther the range of receiving apparatus. Solution was found in the introduction of amplifiers, or magnifiers of the weak currents in the detector circuit. Some form of magnifiers are in reality an ordinary telephone circuit, in that the receiver, connected to the detector, is capped over a microphone transmitter, which in turn is electrically connected to a powerful bat-



THE EIFFEL TOWER STATION IN PARIS—THE WORLD'S TALLEST WIRELESS PLANT

First View: The Eiffel Tower at a distance. Second and Third Views: Portions of the huge transmitter. Fourth View: Switchboard and part of the current-generating machinery

tery and another telephone receiver. Thus the faint sounds of the first telephone receiver are spoken into the microphone, which in turn impresses them on a circuit containing a loud-speaking receiver, or, at least, a receiver that produces loud sounds in the ears of the operator. Other forms of amplifiers utilize a modified form of the audion detector. In the one-step amplifiers of this type, an amplification or magnification of from 6 to 10 times is attained; in the two-step amplifier from 60 to 100; and in the three-step from 600 to 1,000, according to Dr. DeForest, the inventor of the audion amplifier. Thus it will be appreciated that the sensitiveness of the detector is materially improved by the use of an amplifier; and it is the combination of highly sensitive detectors and amplifiers more than anything else that accounts for the remarkable long-distance communication of present-day wireless.

TELEPHONY WITHOUT WIRES

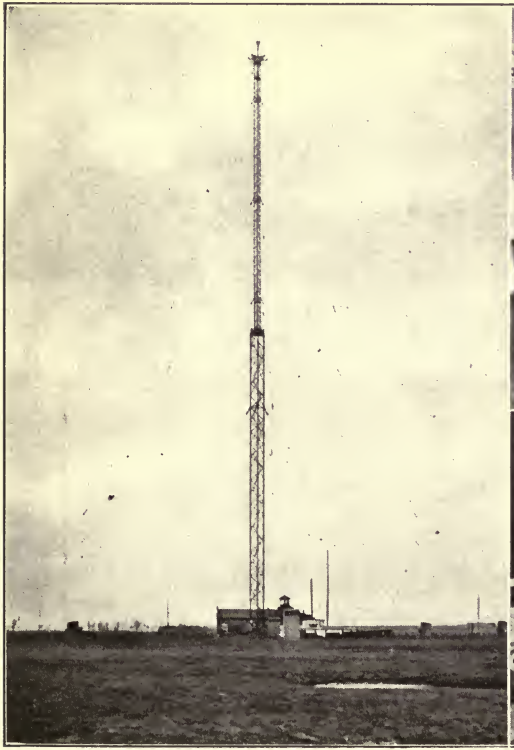
Wireless telephony differs from wireless telegraphy only in details; for in general principles involved they are identical. If the wave trains of a spark transmitter were sufficiently close together to be above the range of audibility when received in the telephone receivers of the operator at the receiving station, it would be but a matter of a few slight changes, such as replacing the telegraph key with a microphone, to convert the average wireless telegraph transmitter into a radio telephone set.

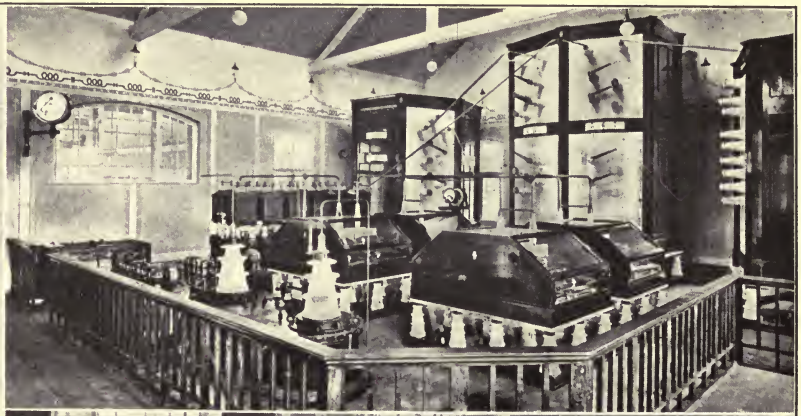
As it is, the requirements of successful radio telephony begin with a generator of undamped waves of very high frequency, so that the wave trains when received are above the range of audibility.

Until recently some form of electric arc was, and still is, employed for generating the high frequency current for a radio telephone transmitter. Although on occasions fair success attends the employment of arc generators, a radio telephone system based on the use of such generators cannot be the ideal system of the future. An electric arc is necessarily unsteady; its electrodes usually burn away at a high rate, resulting in sputtering and frequent readjustment to bring the electrodes closer together to make up for the consumption of electrode material. A constant variation in the consumption of current results in fluctuations in the high frequency current, which is fatal to clear transmission. Yet, despite the shortcomings of the electric arc as a generator of high frequency currents, much progress has been made with it by numerous investigators.

A Danish investigator, Poulsen, has done much toward applying and improving the arc generator for wireless telephone purposes. More recently, Colin and Jeance of France have done considerable work on an arc telephone, on occasions succeeding in communicating over a range of several hundred miles. In America, Dubillier, Collins, DeForest and other investigators have in the past devoted considerable attention to the arc generator with a fair degree of success.

Outside of the microphone, which must be able to handle large volumes of current without injury, in a wireless telephone set the arc generator is the center of interest; and likewise it is true that the generator is the point of divergence between the various systems. The Janke system, for instance, is a variation of the Poulsen arc, in that the arc is placed in liquid alcohol to insure greater steadiness. To impress the voice on the high frequency current, a special water-cooled multiple microphone is used. The TYK system, on the other hand, is not an American system like the former, but a Japanese system developed by Torikato. Its chief value lies in its utmost simplicity. The system consists of a 500-volt arc between points of burnt magnetite and brass, shunted by a





THE NAUEN STATION, NEAR BERLIN, THROUGH WHICH BELLIGERENT GERMANY HAS SPOKEN TO THE NEUTRAL WORLD DURING THE GREAT WAR

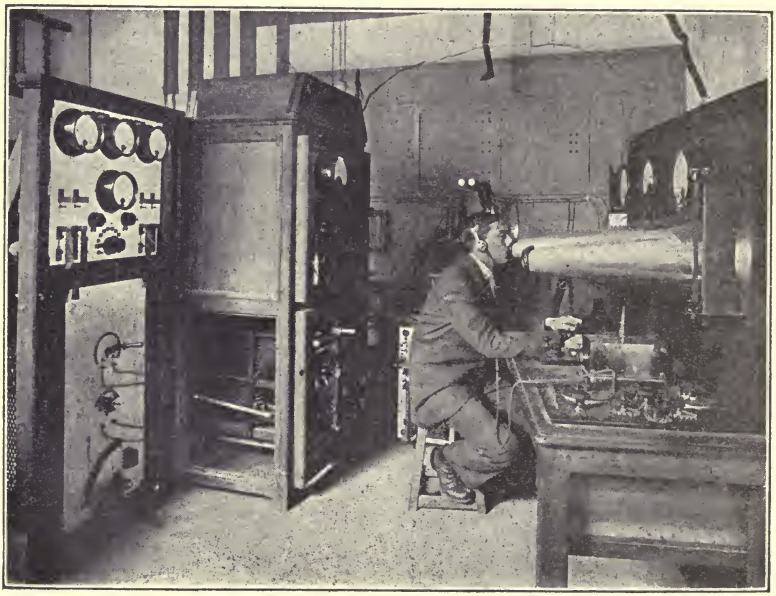
At the Left: The 600-foot mast which supports the aerial system. Above: The transmitter room. Below: The receiving apparatus room

circuit with a rather large capacity and a small inductance. A heavy-current microphone is placed in series with the aerial. Although it is supposed that the TYK system is really an arc system, the inventor is of the opinion that the result produced is a quenched spark of spark frequency beyond the limit of audibility. By a "quenched spark" is meant a discharge that does not oscillate to any appreciable extent; in other words, the discharge rapidly dies out or it is highly damped.

Various quenched spark systems have also been tried, notably that of Ditcham, but as a general thing systems based on the use of quenched spark generators do not possess good speech quality. The speech quality of the TYK system is reported to be poor, which confirms, to some extent, the belief that its generator is a form of quenched spark gap.

High frequency alternator systems have been used as far back as 1906 by Fessenden, but as in the case of their application to wireless telegraphy, even to-day they are considered largely in the light of experiments because of their prohibitive cost, their low frequency and consequently long wave length, and the difficulty of speed regulation.

The reaction vacuum tube systems are the last word in radio telephony, and judging from the results obtained thus far with them there can be but little doubt that they possess the qualities of the ideal apparatus of the future. Marconi, DeForest, and others have, of late, investigated the possibilities of the reaction vacuum tube in connection with radio telephony. DeForest has developed a tube which is a modification of his audion amplifier. Known as the oscillion bulb or tube, this generator, together with



WIRELESS TELEPHONE APPARATUS USED WITH SUCCESS BY COLIN AND JEANCE OF FRANCE IN TRANSMITTING THE SPOKEN WORD OVER SEVERAL HUNDRED MILES

a potentiometer for close regulation, filament rheostat, impedance coils, loading inductance, telephone transformer coil, microphone transmitter, fixed condenser and minor accessories, a current supply for the filament and another of 150 to 300 volts for the production of the high frequency currents, forms a complete radio telephone for short distance transmission. For long distance work a number of oscillions are employed, together with a higher voltage—as high as 1,500 volts for a set with a range of 150 to 200 miles.

Wireless telephony owes much to the work of the engineers of the American Telephone & Telegraph Company who, in the latter part of 1915, succeeded in telephoning by wireless from Washington to Paris, and from Washington to Hawaii, the latter a distance of 4,900 miles. It is understood that a form of reaction vacuum tube was employed in large numbers in generating the high frequency currents required.

At the present moment it seems that wireless telephony, long a laboratory experiment, is at last a commercially practicable means of communication. Even so, however, the great expense of installations for long distance work may cause its universal use to be postponed for years to come, although it is safe to prophesy the widespread employment of short-distance wireless telephone sets for ship-to-shore communication in the immediate future.

HOW THE WORLD USES WIRELESS TELEGRAPHY

The later-day pioneers in wireless telegraphy, even in their wildest flights of fancy, never realized to what extent their work would play a part in the commercial world and in military and naval affairs. True, they prophesied the transmission of energy by means of electromagnetic waves on a vast scale, and even today there does not appear to be much promise of success along these lines. But the fact remains that communication without wires has been applied to a wide range of uses other than those originally planned.

Ship-to-ship and ship-to-shore communication was the original aim of wireless men—radio telegraphy was to be a maritime invention. To-day the greatest employment of wireless remains on the water rather than on land; and always will its greatest field be on shipboard. There is hardly an ocean-going vessel carrying passengers that is not equipped with wireless, for laws have been enacted obliging such ships to carry radio apparatus because of the security it affords the traveler on water. So numerous and powerful are the land stations operating in conjunction with the ships that it is very seldom indeed when a ship is out of touch with land. Ocean travelers receive the news of the world every day, which is flashed out by powerful stations in America and Europe.

Serious work has been done in establishing radio telegraph and telephone communication between moving trains, notably that of the Lackawanna Railroad. Although on certain occasions a range of between fifty and one hundred miles has been covered between a moving train and fixed station, the results on the whole have not been satisfactory. Perhaps it is that the tests have been premature, and that a suitable system of communication, somewhat different from existing ones, must be developed for this particular purpose. Employing an aerial eighteen inches above the roof of a steel car, which is obviously grounded through the rails, it becomes evident that it is almost impossible to secure any distance with a wireless apparatus installed and operated under these conditions.

The European War has given especial impetus to wireless, particularly as applied to aircraft. In designing radio apparatus for airships and aeroplanes due consideration must be given to the extremely lim-

ited space available on such craft, and the limited weight that can be carried. In the case of aeroplanes the guy wires and other metallic parts of the machine are generally used as the ground (the capacity ground), while the aerial is in the form of a trailing wire that is paid out from a reel after the machine has reached the proper height. Most aeroplane sets have a range of from five to thirty-five miles, and because of the intense noise and vibration of the engines it is a very difficult matter to receive messages on board; in fact, military operations make due allowance for this condition and depend upon the aeroplane wireless operator to devote his attention almost exclusively to sending.

On board airships of the Zeppelin or the flexible types it is possible to employ more powerful apparatus, hence a greater range can be covered. A typical airship installation consists of a transformer, quenched spark gap, capacity and inductance, aerial wire lowered down from a winch, ammeter, rapid-change switch for different wave-lengths, and an alternating current generator driven off one of the engines of the airship. Such a set, weighing about fifty-five pounds without the alternator, has a range between 60 and 120 miles. The aerial wire is over 600 feet long when fully paid out.

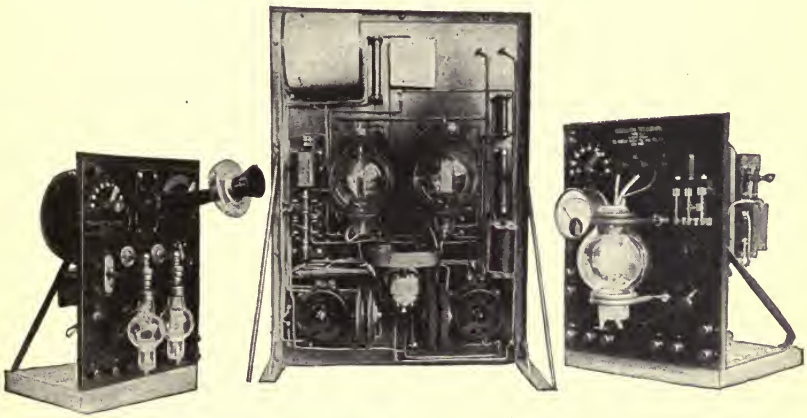
Armies in the field employ portable wireless sets for insuring communication between scattered commands. Some sets for use in rugged country are arranged to be carried on mule-back, and are known as pack sets. But the most common wireless sets are those mounted on two wagons, one for the generating equipment and the other for the wireless apparatus proper. The aerial of these sets is arranged in the form of an umbrella, spreading out in all directions from a common pole. The latter is usually of aluminum or an alloy of that metal, made up of a number of sections which can be readily coupled together. Within five minutes a mast of this kind can be erected, together with the aerial and the counterpoise or capacity ground. Still another form of portable military set is the automobile truck set, which is carried as one unit on a powerful motor truck, and has a range of well over one hundred miles under favorable conditions.

The European War has served to demonstrate the value of long-distance wireless stations for maintaining communication between widely separated countries. Germany has set a mark in the art by maintaining telegraphic communication with neutral countries after finding herself surrounded by enemies on all sides and isolated from the outside world. Through the wireless station at Nauen, near Berlin, the German authorities have been able to give each day to the neutral world the news of the war from the Teuton point of view, without danger of the news being censored or altered in any way by enemy powers. Much of the telegraphic traffic between Germany and the United States during the war has been handled through the Nauen and Eilvese stations in Germany, and the Tuckerton and Sayville stations in the United States.

The Allied powers too, although not isolated from the outside world, have made good use of wireless telegraphy in keeping in touch with each other and in maintaining communications between their scattered armies throughout the globe. It is understood that the Allies in the West and Russia have kept in touch by wireless telegraphy, the Eiffel tower having been used in the West, and a powerful station at Petrograd, for the purpose. Wireless has also been employed to an unprecedented degree in keeping in touch with warcraft of all kinds, even to the submarine boats fitted with folding masts that can be hastily erected to support an aerial when the craft are on the surface.

Upon the completion of the European War a great chain of wireless stations encircling the globe will be put into operation. It is not unlikely that these stations may soon prove a formidable competitor to the cables, although it is doubtful if they can ever be more than a supplement to the older form of inter-continental communication. Many of the world-encircling wireless stations represent the very latest phase of the art, with ranges of thousands of miles, and arranged to receive and transmit messages simultaneously and without interference.

Among other uses of wireless is the collection and distribution of weather information to seamen and others, which service is of great value to all mankind. Wireless has also been applied with success to the problems of higher surveying, particularly by the French in the Sahara and on the Congo in Africa, and by Capt. Edwards on the boundary between Brazil and Bolivia. A careful comparison of time between distant points has also been rendered possible by wireless, which, because of the high velocity at which the electromagnetic waves travel, can be considered as being practically an instantaneous means of communication for such distances as are encountered on this earth.



RECENT WIRELESS TELEPHONE APPARATUS DEVELOPED BY DR. LEE DE FOREST, EMPLOYING THE OSCILLION OR OSCILLATING-VALVE FORM OF GENERATOR

MOVING PICTURE ACTORS IN SELF-CONTAINED DIVING SUITS, TAKING PART IN AN UNDERWATER PHOTOPLAY SCENE

CHAPTER IV.

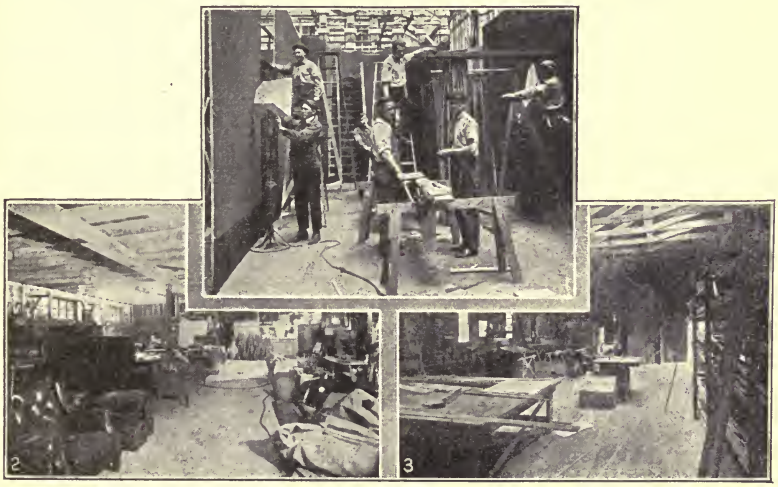
MOTION PICTURES IN THE MAKING

By AUSTIN C. LESCARBOURA

PERHAPS it is because pictures are the ultimate universal language that a world-wide fascination attaches to motion pictures and their production. Or it may be due to the romance of picture making—the story in back of the screen story, which so often excels the tale of the film in point of human interest. But whatever may be the reason, the fact stands that no modern industry commands as great interest among the multitudes as motion pictures, not only in the finished product but in the manufacturing processes.

PHOTOGRAPHS BY THE THOUSANDS

From a purely mechanical point of view, motion pictures are nothing more than a number of photographs of any one object or group of objects taken at frequent intervals on a strip of film. The exposures are made at the rate of sixteen per second; and each picture—a photo-



ARTISANS OF THE FILMS, THEIR STOCKROOM AND THEIR WORKSHOP

(1) Carpenters, painters and electricians at work in the erection of a Vitagraph set. (2) Where the furniture employed in Lasky motion picture productions is stored. (3) The woodworking shop of the Lasky western studio

graph as perfect as the best of lenses and the highest photographic skill can produce—measures but one inch in width by three-quarters inch in height. Perforations are provided along either edge of the film, with which the mechanism of the camera engages for the purpose of intermittently drawing the celluloid strip through the rays of light coming in through the lens, the object being to move the film a trifle over three-quarters of an inch each time an exposure has been made, so as to bring a fresh section of film in the path of the light rays.

The film that is exposed in the camera is generally a negative. It is developed in much the same manner as an amateur film, although its great length calls for the employment of a rack or a drum on which to wind it in order to facilitate handling. The negative developed and dried, it is passed through a printing machine together with fresh unexposed positive stock so as to make as many positive prints as may be required. It is the positive print of any motion picture production that is passed through the projecting machines in theaters and viewed on the screen by the millions.

But let us look in back of the screen: let us glance into the activities of those who make the film productions possible, but who always remain unknown to the audience, while the actors who perform no greater part in the work become famous.

A SUBMARINE THAT NEVER SAW THE SEA

The audience is tense with excitement as the hero in the film play struggles frantically with the control apparatus of a submarine that is fast sinking to the ocean bottom, because of the constantly rising water in its hold. And as he struggles at his post the water pours in on him through an ugly gash made in the conning tower of the craft by an enemy destroyer. Perhaps it is the climax in a gripping drama, then again, it may be the big scene or "punch" in a hilarious comedy. But, however that may be, the realism of the scene has the desired effect on the audience. What dangers these motion picture folk incur in their daily work! is the general comment of the unsuspecting public.

Several months ago the scene in question was acted, not, as might be supposed, in the interior of a submarine, but in a quiet corner of a motion picture studio. The "submarine" was an elaborate structure of wood, metal, and plenty of paint; life-sized to be sure, but only of a sufficient length or depth to represent the particular compartment portrayed in the picture story.

For weeks the artisans of the studio workshops had worked in building this pseudo submarine; and before the camera crank was turned the technical director had gone over every detail of its construction to make sure that it emulated successfully the interior of a modern submarine. Then the studio hands built a tank around the scenery. The "set," as the scenery for a studio scene is called, was now ready for the director.

The director, being unable to carry out his programme of photographing certain outdoor or "location" scenes on a certain day because of rain or poor light, decided to stay at the studio and photograph the interior scenes called for in the scenario or working plan of his picture. After rehearsing the action of this particular scene several times, the lamps flashed up and the camera man took his place by the side of his camera. At the command of the director one of the stage hands climbed up on the deck of the "submarine," pulling a heavy hose after him, which he placed in the opening of the conning tower. The water was turned on, and it flowed through the hose and passed down upon the back of the actor playing the part of the hero-sailor struggling with the control mechanism of a balky underwater craft.

The water, bounded on all sides by the improvised tank of wood and rubberized canvas, slowly rose in the "submarine" interior. The camera, which all the while was recording the action, was naturally so focused as to take in only the desired portion of the setting—the sides of the tank did not show in the film. The scene was a success.

Typical of the striving of all American producers for realism is the foregoing instance. A half dozen years ago the audience of the average picture theater was not as critical as the audience of to-day. Formerly a director depended solely upon a good story and fair acting to make a film production a success; whereas to-day the director strives to reinforce these two essentials with the utmost realism of scenery. It is imperative, claim the producers, that the pictures be replete with realism; the audience must not be permitted to recall the fact that after all the scenes in many instances are but improvised backgrounds and the necessary pieces of furniture taken from the stock room or property room of the studio. In brief, the audience must be made to forget the mechanical end of picture production; and to this end every effort is made to have even the most insignificant details accurate and confidence-inspiring.

BACKGROUNDS MADE TO ORDER TO FIT THE FILM STORIES

(1) A set representing the living room of a country home. Note how the stairway at the left terminates in a wooden platform, beyond the range of the camera, in this Thanhouser set. (2) A set representing an office. The players at the left do not appear in the Gaumont film being produced, for they are out of the range of the camera.

JACKS—AND MASTERS—OF ALL TRADES

No motion picture studio would be complete without its carpenter shop and staff of expert workmen. There are so many things that must be built especially for the pictures that a complete equipment of woodworking and metalworking machines and a skilled gathering of artisans are an absolute necessity.

It would be impossible to describe with any pretense to thoroughness the range of work turned out by the studio workshops. It is only by offering a few examples of what they do regularly that a general idea of the scope of their toil can be gained. One day they may be building a safe of light wood or compressed paper — accurately made even to the bolt mechanism—which may bring forth roars of laughter from an audience months hence when it is dropped on the head of one of the comedians in a film play. They may be called upon to build an aeroplane, closely following the lines of a genuine machine that is to be used in the scenes of actual flying. The workmen may perhaps put in one or two weeks' work in

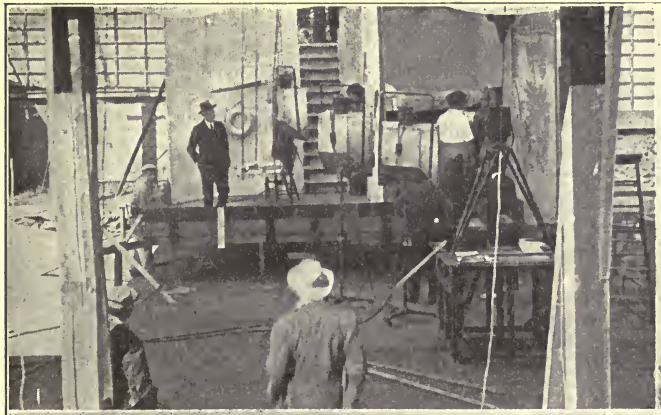
building the aeroplane, exercising much ingenuity in its construction. As likely as not the tires of the landing gear may be made from short lengths of rubber hose or canvas tube, filled with sawdust. And the same degree of ingenuity may be repeated a dozen times or more in the construction of the machine; all this work to appear for a few seconds on the screen, and probably doomed to be blown to pieces or burned to ashes. The men may turn to the construction of a mirth-provoking hose-cart or fire-wagon for the fire department of some imaginary rural community. Again, historical or period plays may keep the artisans busy building a replica of the first steamboat, or making an old stage-coach, or a Roman gladiator's weapons and shield, or even an ancient catapult. All these things are in the day's work.

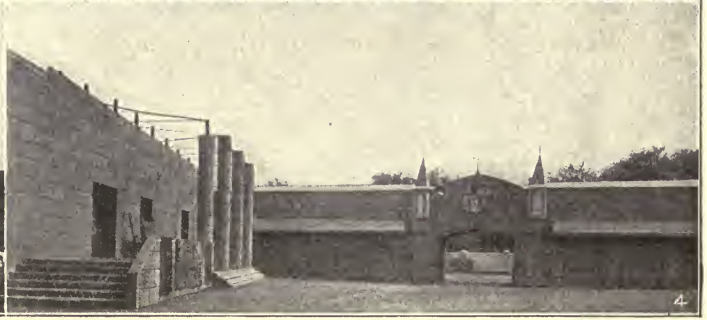
In a recent war play, "The Fall of a Nation," four huge siege guns figured conspicuously in the battle scenes between defenders and invaders. Each gun was a faithful reproduction of the famous Krupp 28-millimeter siege howitzers, mounted on caterpillar wheels. When seen on the screen, even a military expert would be apt to mistake the guns for their counterparts busily engaged on European battlefields. As a matter of fact, however, these "guns" were made of wood, and at the time represented perhaps one of the most intricate pieces of work yet undertaken by the film artisans. They were a faithful copy of the actual pieces, even down to the recoil cylinders which actually functioned following the explosion of a charge of black powder in the metal-lined barrel. The guns were said to have cost the producers of the film some $10,000 each, and although the amount appears rather high at first, nevertheless it serves to accentuate the great amount of preliminary research work and designing that had to be carried out before the actual construction began. And here again the producers insisted that if the guns were to be used at all, they must be accurate enough to pass before the most critical audience without arousing undue suspicions.

The producer of a submarine story, which, in its main essentials, closely follows the theme of Jules Verne's "Twenty Thousand Leagues Under the Sea," recently endeavored to secure the loan of a United States submarine from the Navy Department, without success, so the story goes. Whereupon he set out to build a submarine of sheet iron, with a length of over 100 feet, a beam of 15 feet, and a draft of 4 feet. The shell had to be of sufficient strength to withstand a submergence of forty feet deep. By means of tanks the submarine could take on water in order to settle down beneath the waves, while compressed air tanks permitted of blowing out the water ballast when the craft was to be brought up to the surface again. The submarine was fitted with a torpedo tube capable of discharging a regulation torpedo. In all, six months' time was expended in building this submarine, which closely followed the lines of the "Nautilus," the famous craft of Captain Nemo; indeed, the Navy submarines were hardly suitable to represent the fictitious craft, which may have been one reason why the producer decided to construct a special submersible, fitted with a lock in its bottom through which divers wearing self-contained suits could pass out to the ocean floor.

In a certain production, "The World and the Woman," there was to be a garden scene during a thunder storm. One of the features of the scene was a driving rain, while another was a flash of lightning. The scenario called for these things; there was nothing for the studio artisans to do but to produce the desired effect.

An aeroplane propeller was mounted on a substantial support, and to it was applied the power of an electric motor through belting. An artificial garden set was soon





WHEN APPEARANCES ARE DECEIVING: THINGS THAT ARE MADE FOR FILM PRODUCTIONS

(1) A Thanhouser set representing the interior of a boat, which is mounted on rockers so that it can be swayed to simulate the pitching of a vessel in a rough seaway. (2) A wooden cannon made for a Vitagraph battle picture. (3) A replica of an Aztec temple, the face of which has been covered with over 3,000 plaster paris plaques to represent carved blocks of stone, used in an Ince-Triangle production. (4) Setting erected in the yard of the Essanay studio and used in a film to represent the courtyard of a palace.

arranged and housed in a suitable shelter to make it dark—the photographing took place in the yard of the studio, in the middle of a beautiful day. Above the set was arranged a trough, perforated with many holes to allow water to drop below on the scenery. When everything was ready, the electric motor was started, causing the aeroplane propeller to blow up a veritable hurricane through the set. Stage hands with watering cans began to pour water into the trough, which fell in the form of rain only to be driven at an angle across the setting, simulating a powerful gale. And at the propitious moment another stage hand set off a flashlight, giving the desired flash-of-lightning effect on the film.

All of which bespeaks well of the skill of the artisans of the screen. Most of their work is done in wood and canvas, although occasionally they resort to metal, as witness the submarine already mentioned. Papier maché, plaster of Paris, compressed fiber and clay are also used in profusion, especially in the making of statues, ornate panels, and other work of a similar nature, forming part of elaborate sets.

The equipment of most motion picture studios is usually such as would do justice to a thriving woodworking shop and machine shop combined. A typical comedy-producing studio in southern California, for instance, has over $2,000 worth of woodworking equipment in its carpenter shop, while the stock of lumber constantly on hand and other items are said to bring the total up to $4,000. The concern employs regularly over seventy-five carpenters.

BUILDING INTERIORS TO FIT THE STORY

The interior settings of a film play require the closest attention on the part of the producers. For here again the constant demand for accuracy and realism is paramount. The smallest details must be watched. If the director calls for a tenement house scene, the stage carpenters must build him a dilapidated hall and stairs, and small, squalid rooms. The scene must appear much the worse from wear and old age—the steps must look worn; the walls must be marred, with here and there a hole in the plaster; and there must be dirt a-plenty. Again, if the director calls for the home of a rich man, it is necessary that he state what kind of rich man the film author had in mind. Is he a wealthy man from a family of long

BRAINS AND SKILL AT WORK IN THE MOTION PICTURE STUDIO

At the left: The technical director of the Vitagraph studio supervising the arrangement of the furnishings in an elaborate set. At the right: Film artisans at work, making the various objects required in Vitagraph pictures.

SEEING WHAT THE CAMERA IS NOT ALLOWED TO SEE IN MOTION PICTURE PRODUCTIONS

(1) Filming a Vitagraph actor who is looking through a hole in the floor. Note the "baby" or diminutive tripod used for taking pictures close to the ground. (2) A set that serves to represent the stairs and hall of a house. (3) Taking a close-up scene, showing the actress, director and camera man at their respective tasks. (4) Filming a newspaper office scene, the set for which has been erected in the Vitagraph studio. (5) Securing a storm scene on a perfectly clear day in the yard of the Thanhouser studio: an aeroplane propeller is used to create the wind, and the rain is produced by pouring water into a perforated tank placed above the set. A flashlight furnishes the lightning.

standing, or is he a *nouveau riche*? If he belong to the former class, the furnishings are to be of a quiet, harmonious design, with the paintings and other ornamentation typifying good taste; while if he belong to the latter, the furnishings must be of a garish sort. For it is in this manner that the motion picture producer endeavors to amplify the type of man whose home is represented. And motion picture traditions have it that a man with newly-acquired wealth must have garish tastes, and that a tenement house must always be old, dirty, and much the worse from excessive wear. In other words, exaggeration is practiced in order to leave little to the imagination of the audience.

Obviously, it would not do to leave the selection of furnishings and their proper arrangement to stage hands and carpenters, and accordingly the demand for accuracy and realism has brought into existence a new type of executive in the film industry—the technical director, or art director as he is sometimes called. To him falls the task of reading through the synopsis or scenario of a film story, followed by the supervision of the erection of sets. He is responsible for the arrangement of the furnishings, even down to the smallest details, as well as for the costuming of the players. However, he is not responsible for the action part of a scene; that task remains, as ever, the work of the director.

The technical director must be a veritable human encyclopædia—a man of remarkably broad knowledge and experience. He must be well read; and what he does not know he must be able to "dig up" at short notice. Here is how his knowledge and experience are applied:

If a scene is laid in a certain country and the time is of a different century, he must know what garments the players are to wear, the accouterments of the soldiers, the etiquette of the period and country, the furnishings of the interiors, the head-dress of the women, and a thousand and one other details.

Perhaps actual incidents are most convincing in illustrating how the directors strive for accuracy, and how the absence of technical direction may be fatal to an otherwise perfect production. The story is told of how Irvin Cobb, the noted American writer, was visiting a prominent Los Angeles studio while a director was rehearsing a scene of a war play in which a regiment of German soldiers were marching through a Belgian village. To add what he considered a touch of comfort and naturalness to the scene, the director had the men leave their coats unbuttoned. Mr. Cobb, then only recently returned from the war zone, was horrified at this gross misrepresentation of facts. He did not hesitate to tell the director that at no time do the Germans have their coats unbuttoned while actually on the march or on duty. The director was grateful for the tip, for he realized the humiliation that might have been his if the otherwise perfect scene were held up to ridicule by the better-informed of the millions who would ultimately view the picture. At the same time the author also commented on the wearing of the Iron Cross decoration, which the director had insisted the men should wear conspicuously, whereas it is actually tucked away with only its ribbon showing. Can there be any doubt of the necessity of a technical director?

To return to interior settings: These represent one of the big items of expense in the production of a film. One reason is that the average set can be used in one production only, after which it must be dismantled. In the earlier days the audience might not have commented on seeing the same pieces of furniture used several times. But to-day the audience is more observing and will soon detect any attempt to use the same lamp, settee, or other fur-

TOWNS AND CITIES IN MOTION PICTURE LAND—FRONT AND BACK

In the upper views appears a frontier town in process of construction and the same town completed. It will be noted that the buildings consist of walls and roofs, supported inside by means of props. In the lower views are seen the buildings of the mythical Government seat portrayed in "Civilization," and how the same buildings appear when viewed from the rear. Both of these outdoor sets were erected for Ince-Triangle productions.

nishings repeatedly. Conspicuous repetition has got to be avoided by the producers. And as in the instance of the garments worn by the players, the furniture must be in keeping with the last word in interior furnishings. So every studio maintains a large room or several rooms in which an almost endless variety of furnishings is stored.

The walls of an interior set are generally built of compressed paper or light board, backed up with framework and props, to facilitate the work of erection and destruction. Tremendous quantities of the necessary materials are employed in the course of a year, as witness some 50,000 feet or more of compressed paper board used by a leading comedy producer, together with over 500,000 feet of lumber. The same concern spends over $1,800 for some 15,000 rolls of wall paper each year, with which to cover the walls of its sets.

The cost of even the most modest set runs up into the hundreds of dollars, for it must be remembered that practically every set must be built and decorated to order, and filled with the necessary furniture, which may not be used for a long time to come. Elaborate sets run up into the thousands of dollars. A good restaurant or cabaret scene may cost from $2,000 to $5,000, depending upon its elaborateness and size. A setting calling for intricate electric lighting effects sometimes exceeds the $5,000 mark, for instance, the witches' scene in the recent production of "Macbeth," starring Sir Herbert Beerbohm Tree, which is said to have cost over $10,000 because of the elaborate apparatus for producing the weird fire effects.

IN THE LAND OF TWO-DIMENSIONED STRUCTURES

The film artisan finds his biggest field of endeavor in the outdoor sets, for under the open skies his undertakings are not hindered by space limitations and can therefore assume the most gigantic proportions. Here again, the striving for realism is the first consideration; here the technical director must exercise his knowledge of architectural design covering every period in history and every part of the world.

Perhaps the greatest set that has ever been constructed up until the time of writing was one representing the ancient city of Babylon, employed in the gigantic production "Intolerance." On the front of this huge setting—the side that faced the camera—there rose high walls painted to simulate stone, 100 feet in height and adorned with reliefs of strange winged creatures and elephants. The towers of the set stood 135 feet high, and the various structures covered a ten-acre tract of land in Hollywood, Cal., just outside of Los Angeles. For more than six months the carpenters, masons, concrete workers and painters were busied with the set, and the cost of the work is reported to have been in excess of $50,000.

But slightly less pretentious was the set erected at an approximate cost of $35,000, representing the palace, house of parliament, prison, royal court, and adjacent buildings in a mythical country featured in the production "Civilization." The first spadeful of earth in preparation for the erection of the set was turned in May, 1915. The completed set was ready for use in November of the same year. Into its construction went thirty carloads, or approximately 600,000 feet, of lumber. Glass valued at a total of $4,000 was necessary for the several hundred windows, while tons upon tons of cement and plaster were used as the other principal materials. For the steps of the largest building alone ten tons of cement was used. The sidewalks, with their curbings, measured some 1,200 feet, and twenty men were employed for three months laying them out and arranging the parkings between them. Trees, shrubbery and lamps were among

the ornaments placed within the boundaries of the set. Covering an area of over six and one half acres, the set has stood atop one of the hills in southern California, enduring the elements successfully as though it were intended as a permanent structure.

It is principally in portraying foreign scenes that the film artisans are called upon to build elaborate sets. Years ago, before the industry had reached its present high standard, companies traveled abroad in order to produce plays at the actual locations called for by the scenario. To-day, in marked contrast, the producers find it easier to bring the foreign or distant spots to the studio, literally speaking. Accuracy enables them to convince the audience that the scenes have been laid in the country called for by the story. All parts of the world have been brought to the foothills of California, the shores of Florida, and the edge of the Palisades of New

FIRST MOVING PICTURE STUDIO IN THE U. S., BUILT IN 1905

This structure was mounted on pivots so that it could constantly be turned to keep the sunlight streaming in through its crude skylight.

Jersey, where the producers have better laboratory facilities, understand the light conditions, can secure experienced players—and save time.

Typical instances of foreign sets have been the barracks of Delhi, India, and a street in a village of a mythical country, recently erected and used by a Western producer. The former consisted of seven individual structures and entailed an expenditure of $3,000; the latter represented a street lined with houses of solid construction. The houses were made of plaster-covered timbers, while the stone walls and trees were handled with great care to obtain correctness of detail. The entire set required about six weeks to build and involved an outlay of perhaps $5,000.

There is practically no end to the elaborate outdoor sets erected by motion picture producers. In the production of "Ramona" it was said that over 1,800 sets were especially built for the play, and that the picturesque Spanish monastery for one of the sets cost some $10,000.

A commendable piece of work was the set representing the temple of an Aztec monarch in the sixteenth century, which was used in the production "The Captive God." Its framework was built of timbers, but the body was of plaster plaques. About 7,000 of these plaques were required; and the total cost of the set is said to have been $3,000.

A set representing a border town on the line separating Mexico from the United States, for use in a typical Western drama, was recently constructed at a cost of $1,500. It consisted of fifteen buildings, each entirely of frame construction. While the cost of the village was not great, at the time it was regarded by film men as one of the most realistic sets ever built for the screen.

Thousands of other sets might be described, for they come and go without end. But enough instances have been cited to prove that the production of motion pictures is a costly enterprise if realism is to be secured. Also, there is to be found no more skilled and ingenious artisan than the artisan of the screen, whose work, generally unappreciated, plays so conspicuous a part in the remarkable productions of our day.

Cirrus
Cumulus

CLOUD FORMS

Alto-cumulus
Strato-cumulus

CHAPTER V.

THE REALM OF THE AIR

By C. F. TALMAN

THE gaseous envelope of the earth which we call the *atmosphere* is interesting not only as the environment of life, in all its forms, but also as the seat of various remarkable physical phenomena. Considered especially with reference to their biological, and above all their human, relations, the activities of the atmosphere are known collectively as *weather;* but the study of the atmosphere, the science we call Meteorology, is broader than the study of weather. Hence, if weather is important, and everybody knows that it is immensely so, in terms of health, comfort and dollars, meteorology is still more important. This science ought to be, but is not yet, represented by professorships in every university in the land.

EXTENT AND COMPOSITION OF THE ATMOSPHERE

The lower part of the atmosphere is the densest because it is compressed by the weight of the air above it. Thus it happens that, although the total depth of the atmosphere is probably at least 300 miles, one-half of its mass., i.e., one-half of the quantity of matter in it, lies below an altitude of about three and one-half miles above sea-level, while about seven-eighths lies below the ten-mile level. Above about five miles the atmosphere is too rare (or rather the oxygen in it is too rare) to support life. The highest ice-clouds seldom occur higher than ten miles. Storms hardly ever reach this height. In short, the phenomena of life and the phenomena of weather are confined to a layer of air so shallow, in proportion to the dimensions of our globe, that on the surface of an orange it would be represented by a sheet of paper thinner than the average book-paper.

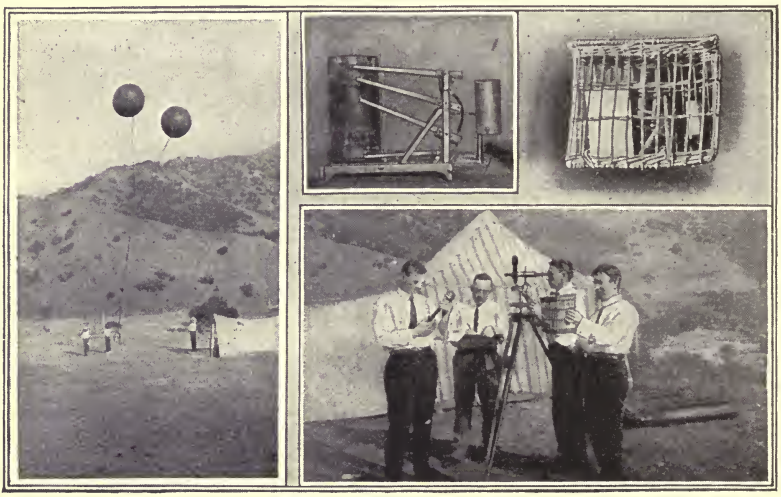
Dry air is a mixture (not a chemical compound) of several gases, viz., about 78 per cent nitrogen, 21 per cent oxygen, 1 per cent argon, and 0.03 per cent carbon dioxide, by volume, besides minute quantities of hydrogen, neon, krypton, xenon, helium and possibly other substances. At levels habitable by man the air always contains invisible water vapor (from a small trace to about 5 per cent), and usually small and variable amounts of ozone, ammonia, nitric acid, and other gases, which, on account of their irregular occurrence, are not classed among the normal constituents of the atmosphere. Lastly, the lower air always contains solid impurities, in endless variety, generically known as *dust.*

THE UPPER AIR

Such is the composition of the air for a few miles above the earth, but the proportions of its constituents do not remain the same at higher levels, since the lighter gases extend farther upward than the heavier. Probably there is no water vapor above about 12 miles; no oxygen above about 60 miles, and no nitrogen above about 70 miles. From a level of about 50 miles upward the atmosphere, instead of being "air,"

is mostly hydrogen—the lightest known gas. Moreover, at the 50-mile level the atmosphere is less than 1/75,000 as dense as at sea-level; i. e., it is more than seventy-five times as attenuated as the best "vacuum" obtainable with an ordinary mechanical air pump. At 300 miles above the earth it is computed to be about one-two-millionth as dense as at sea-level. Ozone, which occurs transiently and in small amounts in the lower atmosphere, is believed to be permanently present and abundant at high levels, where it is formed from oxygen, probably under the influence of ultra-violet light from the sun and of auroral discharges. The existence in the atmosphere of a gas unknown to chemists and lighter than hydrogen has been maintained in some quarters (especially by Dr. Alfred Wegener), and it has been named "geocoronium," or "zodiacon." If present at all, it is presumably the chief constituent of the atmosphere in the upper levels.

The past twenty years have witnessed a remarkable development of upper-air research, or *aërology*. Up to a height of about four miles the atmosphere has been extensively explored by means of self-registering meteorological instruments (*meteorographs*) attached to kites—not of the schoolboy pattern, but box or cellular kites, the "string" of which consists of several miles of steel wire, wound around the drum of a power-driven winch. Captive balloons have also been utilized to some extent. For attaining great altitudes, however, free balloons must be used. The so-called *sounding-balloon*, which carries a meteorograph, bursts far above the earth, and the attached instruments are carried gently down by a parachute, or an auxiliary balloon. Sounding-balloons rise to various heights up to 20 miles. Small balloons sent up without a meteorograph attached, merely for the sake of observing the drift of the air at various levels, are

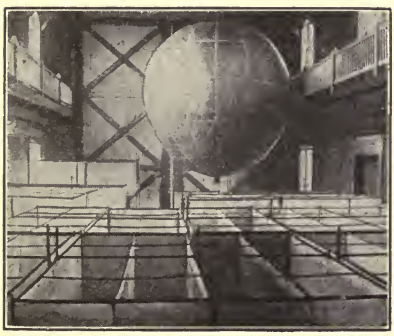


SOUNDING THE UPPER AIR

Left: Launching a pair of sounding balloons, with self-registering meteorological instruments attached. Upper right: Balloon meteorograph and the protective cage in which it is sent aloft. Lower right: Weather Bureau party making upper air observations.

called *pilot-balloons*. An altitude of more than twenty-four miles has thus been attained.

Since the year 1902 it has been known that the atmosphere is divided into at least two layers, or shells, having quite different characteristics. If from some place in middle latitudes we could travel in a balloon as far upward as we pleased, carrying a thermometer with us, we should find the air rapidly growing colder, at a more or less uniform rate, as we ascended until we reached an altitude of about seven miles. Then the fall in temperature would abruptly cease, and might even be succeeded by a slightly rising temperature for a certain distance upward. This would indicate that we had passed out of the *troposphere*, as the lower stratum of the atmosphere is now called, and entered the *stratosphere*, or *isothermal layer*, in which there are no very decided or regular changes of temperature with altitude. The boundary between the two layers lies much higher in equatorial regions, and the temperatures at the summit of the troposphere in such regions are lower than anywhere



KITE AND BALLOON HOUSE AT AN AEROLOGICAL OBSERVATORY

else in the atmosphere. A sounding-balloon over Batavia, Java, has recorded 133 degrees below zero, Fahr., at an altitude of about ten miles. Besides differing from the troposphere in its lack of regular temperature contrasts in a vertical direction, the stratosphere has an independent circulation; concerning which, however, not much is yet positively known.

THE PRESSURE OF THE ATMOSPHERE

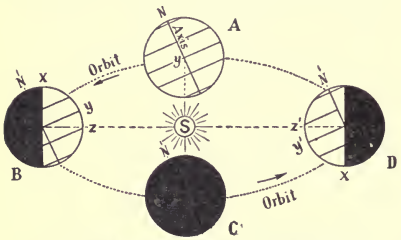
The atmosphere presses down upon the earth with a weight which, at sea-level, amounts, on an average, to 14.7 pounds to the square inch. This pressure is, at any point, exerted equally in all directions; it acts, for example, on the whole surface of the human body, and this means that a man of average size lives under a burden of some seventeen tons of air. He is not incommoded because the pressure from without is balanced by that of the air inside his body. The pressure of the air decreases upward at the same rate as its density; at an altitude of three and one-half miles it is about half as great as at sea-level. Thus the atmospheric pressure on mountains and plateaus is considerably less than in lowlands. At no place is the pressure invariable, nor is there a constant relation between pressure and altitude; but, knowing approximately the average atmospheric pressure over the earth's surface, and knowing also the area of the latter, we can compute in round numbers the total weight of the atmosphere—about 5,000,000,000,000,000 (5 quadrillion, according to American notation; 5,000 billion, according to British notation) tons. This is about 1/1,200,000 of the entire weight of the terrestrial globe.

The pressure of the air is measured by means of an instrument called the *barometer*, and hence is often referred to as "barometric" pressure. In this instrument the weight of the air is balanced against a column of mercury, and the height of the latter, generally expressed in inches or millimeters, is taken as the measure of the former. Hence, when we say that the average barometric pressure at sea-level is 29.92 "inches," we are really expressing

in a roundabout way the weight of the air at that level.

HOW THE ATMOSPHERE IS HEATED

Our life and our weather are both maintained by a tiny fraction—less than half a millionth—of the heat given off by the great luminary around which the earth revolves in space. At any given moment half the surface of the globe basks in the sunshine while the other half is in shadow. Besides rotating on its



THE MARCH OF THE SEASONS

S, the sun; *N*, north pole of the earth; *B*, winter in N. hemisphere and summer in S. hemisphere; *D*, summer in N. hemisphere, winter in S. hemisphere; *A*, *C*, equinoxes.

axis once a day, the earth revolves around the sun once a year, and its axis, which always remains parallel to itself, is inclined to the plane of its orbit. These facts (illustrated in the accompanying diagram) explain the alternation of day and night, the march of the seasons, and the opposition of the latter in the two hemispheres. The northern half of the globe receives more than its share of solar heat at the season when the southern half is receiving less, and *vice versa;* hence the northern summer coincides with the southern winter, and the northern winter with the southern summer. The amount of heat received at a particular place, at a given time, depends chiefly upon the angle at which the sun's rays reach the ground, and this is continually changing. The interposition of clouds, variations in surface topography, different heat-absorbing properties of water and land, and a number of other complications accentuate still further the contrasts in temperature between different parts of the earth's surface, and these contrasts give rise to the *winds.*

Some of the heat that comes to us from the sun is absorbed in its passage through the atmosphere, but the greater part of it penetrates to the earth, where it is absorbed, and then given out to the lower strata of air. Thus our atmosphere is heated chiefly from below. The air that is heated at the earth's surface expands in all directions, but especially upward, where it encounters the least resistance. Moreover, air that has risen and spread out laterally increases the pressure on the air over which it has flowed, and this lower air pushes in toward the over-heated area. The inflowing cooler air helps to drive the heated air upward. In other words, the heated air does not rise merely on account of its expansion, but because it is pushed up by the air around it. Philosophically speaking, our atmosphere is kept in motion by solar energy, just as a steam-engine is kept in motion by the energy of fuel.

Since the atmosphere is relatively very shallow, the distances the air rises and falls under the effects of temperature are extremely small compared with the distances it is carried over the surface of the earth. It is chiefly the horizontal movement of the air that we think of as "wind," but the up-and-down movement is an essential part of the process and has several important effects.

THE GENERAL WIND OF THE GLOBE

In the equatorial regions the surface air is heated more than elsewhere, and rises and overflows, at high levels, toward the poles; while the relatively cold air of high latitudes flows equatorward, near the earth's surface, to replace it. A simple circulation between the equator and the poles could, however, only occur if the earth did not ro-

tate on its axis. The "deflective force" of the earth's rotation causes a particle of air moving in any direction over the earth's surface to deviate—to the right in the northern hemisphere and to the left in the southern (a phenomenon that is not limited to air movements, but applies in general to bodies moving freely over the earth). At about latitude 30 degrees the winds coming from the equator have been so much deflected that they move almost eastwardly. The result is a great whirl around the pole, occupying most of the temperate zone in each hemisphere, with prevailing winds from the western quadrant at all levels. The centrifugal force of this whirl causes the air to bank up at about latitude 30 degrees, producing a belt of high pressure in that region, which is sometimes known as the *horse latitudes.*

Between this belt and the equator there is a regular circulation of air equatorward below (the *trade winds*) and poleward above (the *anti-trades*); and both these systems of winds are given an oblique direction by the earth's rotation. Near the equator, between the two trade-wind systems, is a region of calms and variable winds, with abundant clouds and rain, known as the *doldrums.* Trades and doldrums shift alternately north and south in the course of the year, following the sun, and give to regions which come under their control, successive *dry* and *rainy seasons.* Within the polar circles the low temperatures increase the density of the air, which flows away from the poles near the earth's surface; an effect that appears to be strengthened by the drainage of air down the glacier slopes of the two polar continents (Greenland and Antarctica).

The accompanying table shows in a general way the arrangement of the principal wind-belts of the earth. This represents prevailing conditions, which are, however, subject to many interruptions. In middle latitudes, for example, while the prevailing drift of the air is eastwardly, the actual wind at any place and time is usually determined by the positions of cyclones and anticyclones (of which we shall say more presently). Any of these general wind-systems may be disturbed by the seasonal winds known as *monsoons,* which blow outward from a continent to the ocean in winter and in the reverse direction in summer.

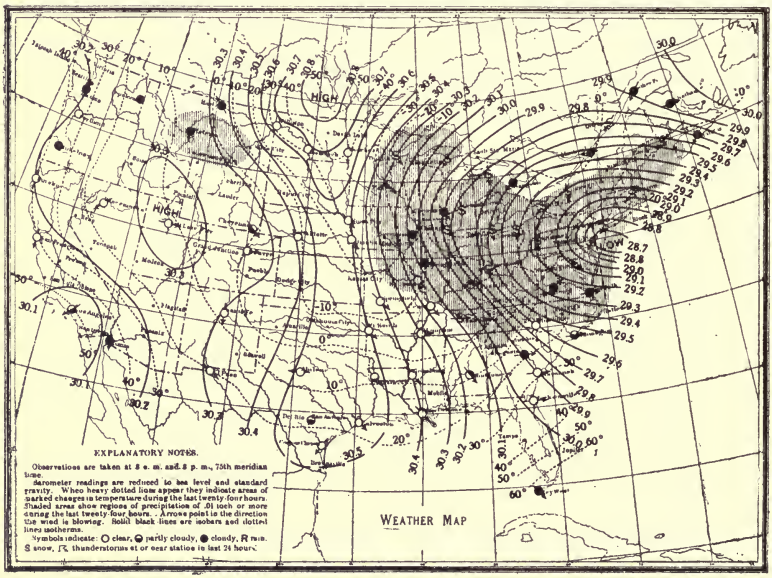
NORTH POLE
Arctic calms and outflowing winds, deflected westwardly (with poleward winds overhead).
Westerly to southwesterly winds of middle latitudes.
Horse latitudes ("calms of Cancer").
Northeast trade winds (with southwest anti-trades overhead).
Doldrums, or equatorial calms (with east winds overhead).
Southeast trade winds (with northwest anti-trades overhead).
Horse latitudes ("calms of Capricorn").
Westerly to northwesterly winds of middle latitudes (including the "brave west winds" of southern oceans).
Antarctic calms and outflowing winds, deflected westwardly (with poleward winds overhead).
SOUTH POLE

Interruptions on a smaller scale arise from a day-and-night alternation of winds to and from bodies of water (*land and sea breezes; land and lake breezes*), and a similar daily reversal of the wind direction in mountainous regions (*mountain and valley breezes*).

CYCLONES AND ANTICYCLONES

Cyclones and *anticyclones* are areas of low and high barometric pressure, respectively, exhibiting certain typical conditions of wind and weather. In this country the term "cyclone" is persistently misapplied by the newspapers and the public to a very small intensely violent storm of the "spout" variety, properly known as the *tornado*. The true cyclone covers an area thousands of times as great as that covered by a tornado, and its winds may be either stormy or gentle. In the northern hemisphere the winds of a cyclone blow "counterclockwise" (opposite to the direction followed by the hands of a clock) around the center; not in circles, but more or less spirally inward. In the southern hemisphere their direction is reversed. The anticyclone has a circulation opposite to that of the cyclone (clockwise in the northern hemisphere and counterclockwise in the southern).

There are certain regions of the globe in which cyclones or anticyclones of large extent (known as "centers of action") tend to persist through a season or the whole year, though with fluctuations in size and activity. Most cyclones and anticyclones, however, travel over the earth, and those of the temperate zone (the "lows" and "highs" of the weather map) move in a general west-to-east direction. In the United States their speed averages about 600 miles a day. (This refers to the translation of the whirl as a whole, and not to the force of its winds.) In general, cyclones are attended by clouds and rain or snow;



A FREAK OF THE TORNADO

anticyclones by fair weather. The temperature commonly rises with the approach of a cyclone, and falls in its rear. It is the constant passage of cyclones and anticyclones over the country that gives us our changeable weather.

On the weather map these areas are depicted by drawing lines, called *isobars*, connecting places having the same barometric pressure. Wherever the isobars are crowded the winds the strong; where they are widely spaced the winds are gentle.

The tropical cyclone (*hurricane* of the West Indies, *typhoon* of the China Sea, *baguio* of the Philippines) is a relatively violent whirl, which originates in the stagnant air of the doldrums, and usually moves in an oblique and curved path toward higher latitudes, frequently passing into the temperate zone, where it increases in size and decreases in strength. While middle-latitude cyclones occur throughout the year, tropical cyclones are almost limited to particular seasons (those of the West Indies are commonest from July to October), and they are also confined to rather small regions of the globe. Storms of this type cause frightful devastation in the Caribbean Sea and the Gulf of Mexico, and occasionally in the southeastern United States (as at Galveston, September 8, 1900, when 6,000 lives and $30,000,000 in property were destroyed, chiefly by the great waves generated by the storm).

TORNADOES AND THUNDERSTORMS

The *tornado* is a small vortex in the atmosphere, occurring generally in the southeastern part of a cyclone, and rarely experienced, in its full development, elsewhere than in the United States, east of the Rocky Mountains. Its average diameter is about 1,000 feet, and it travels along a path varying in length from a few hundred yards to 200 or 300 miles. The whirl as a whole moves at a speed averaging 25 miles an hour, while the velocity of rotation probably sometimes amounts to 500 miles an hour—a wind-force far exceeding that of any other type of storm. Within the narrow track of the disturbance buildings are blown to bits, trees are uprooted, and human beings only find safety underground; but close on either side of the track little or no damage is done. The position of the whirl is marked by a funnel-shaped cloud. *Waterspouts*, which occur on the ocean and other large bodies of water, are similar in character to tornadoes, though generally very much less violent.

Thunderstorms occur chiefly in warm climates and during the warm season in temperate climates, but they are by no means unknown in the polar regions. They are characterized by rapidly rising air currents, which may be either incidental

ONE OF THE FEW AUTHENTIC PHOTOGRAPHS OF A TORNADO

to the circulation of a cyclone or due to local overheating of the ground under strong sunshine. Cyclonic thunderstorms sometimes occur along a line several hundred miles in length, extending radially from the center of a cyclone, and sweeping over the country at a fairly uniform speed. This phenomenon is called a *line-squall.*

The electrical features of a thunderstorm are the result and not the cause of the atmospheric movements. The process by which the clouds become so strongly electrified as to give rise to disruptive discharges between cloud and earth, or cloud and cloud, is not yet settled beyond controversy, but has been plausibly ascribed to the breaking up of raindrops in uprushing air currents, and the consequent separation of positive from negative electricity. *Lightning* owes its luminosity to the heating of the air along the path of the electrical discharge. The sudden expansion of the heated air produces the sound-wave we call *thunder.*

A flash of lightning sometimes consists of a single virtually instantaneous discharge; but in other cases several discharges occur in rapid succession along the same path, giving to the lightning a flickering appearance. The duration of a multiple flash of this character may amount to half a second or more. When such a flash is photographed with a camera swinging on a vertical axis, the successive flashes appear side by side on the plate. The rare form of discharge known as *pearl* or *beaded lightning* presents the appearance of a string of luminous beads. Still rarer is *rocket lightning,* which shoots up into the air at the apparent speed of a skyrocket. *Ball lightning,* which takes the form of a globe of fire moving slowly through the air near the earth (sometimes indoors) has not yet been satisfactorily explained. *Heat lightning* is the reflection on the clouds of ordinary lightning too distant to be audible.

Lightning is far more destructive in the rural districts than in cities and towns. In this country the average annual property loss from this cause is about $8,000,000, while about 1,500 persons are affected annually by lightning stroke, one-third of this number being killed. The efficacy of well-constructed lightning-rods is not doubted by competent authorities. Statistics show that they reduce the fire hazard from lightning by 80 to 90 per cent in the case of houses, and by as much as 99 per cent in the case of barns.

OTHER ELECTRICAL PHENOMENA

St. Elmo's fire (also known under a score of other names) is a brush discharge from the points of terrestrial objects, and is most common on mountains. It is also seen on the masts and spars of vessels. Brush discharges on a vast scale are said to occur along the crest of the Chilean Andes, whence they are visible hundreds of miles out at sea.

The *aurora* (called *aurora borealis* in the northern hemisphere and *aurora australis* in the southern) is now most commonly attributed to the passage of cathode rays through the atmosphere, under the effects of some kind of radiation or emission from the sun. It is especially common and brilliant at times when sunspots are numerous, and is accompanied by disturbances in the earth's magnetism. The aurora has been carefully studied in high latitudes by means of simultaneous photographs from two stations, whereby its altitude and distance from the place of observation can be determined. There appear to be two principal forms: viz., a tranquil, homogeneous arc, occurring only at great altitudes, and shifting beams and "draperies," occurring mainly at lower levels. There is some evidence that a feeble auroral glow commonly extends over the whole nocturnal sky, in all latitudes (*earthlight*).

MISCELLANEOUS WINDS

A wind blowing from a warm re-

gion toward a cyclonic center is called, in southern Europe, a *sirocco*, and this term is sometimes applied to similar winds elsewhere. Such winds are commonly associated with the heated terms or "hot waves" of our American summers. Winds blowing in winter from regions of high barometric pressure and low temperature bring us *cold waves* and sometimes *blizzards* (the latter term implying the presence of driving snow in addition to high wind and low temperature). The *northers* of Texas come under this head.

A *foehn* (pronounced like "fern" but without the *r*) is a wind which has been robbed of much of its moisture through precipitation (rainfall) on the windward slope of mountains, and which is further dried and heated in descending the leeward slope. (The heating is due to the "adiabatic" process, an explanation of which will be found in physical and meteorological textbooks.) In the western United States such a wind is called a *chinook*. Its effects are most pronounced in winter, when it brings about a very sudden rise in temperature and causes snow to vanish as if by magic, whence it has been nicknamed the "snow-eater." The *bora* of the Adriatic and the *mistral* of the French Riviera differ from the *foehn* in the fact that they blow from a cold mountainous interior to a warm coastland, and, therefore, though heated in their descent, produce the impression of a cold wind.

Types of wind, the world over, are not numerous; but as the local examples of a given type were named before their generic identity was recognized the number of wind names in use amounts to several hundred. The *khamsin*, *harmattan*, *simoon*, *leveche*, *leste*, *levanter*, *pampero*, *zonda*, *buran*, *purga*, *brickfielder*, *southerly burster*, *williwaw*, *pontias*, *tivano*, *ora*, etc., are a few of these locally named winds.

MOISTURE IN THE AIR

For a given temperature of the air there is a maximum amount of moisture that can be present in an invisible form (water vapor). When the air is charged to the limit it is said to be "saturated." Absolute *humidity* is the weight of water vapor present, per unit volume, or the tension of this vapor; *relative humidity*, the ratio of the amount present to the amount necessary for saturation, expressed in percentage. Cooling of saturated air causes condensation, in the form of cloud, fog, mist, rain, snow, hail, dew or hoarfrost. The temperature at which condensation occurs is called the *dew-point*, and this varies with the humidity.

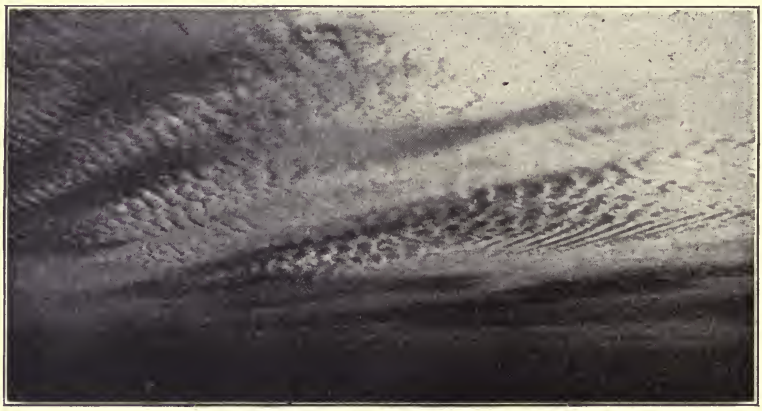
BESSON'S NEPHOMETER FOR MEASURING CLOUDINESS

The highest *clouds* consist of ice needles, and present a feathery appearance. Fleecy-looking clouds are composed of little droplets of water. According to the International Cloud Classification there are ten

principal forms of cloud; viz., three feathery forms, *cirrus*, *cirro-stratus* and *cirro-cumulus*, and seven fleecy or homogeneous forms, *alto-cumulus*, *alto-stratus*, *strato-cumulus*, *nimbus*, *cumulus*, *cumulo-nimbus* and *stratus*. A few subordinate forms are also recognized. A common type of cirrus is popularly called "mares' tails," cirro-cumulus is known as "mackerel sky," cumulus is called "w o o l p a c k," and cumulo-nimbus "thunder-clouds," or "t h u n d e r-heads." Nimbus is the rain cloud.

A cloud at the earth's surface constitutes *fog*. *Haze* is a turbid state of the atmosphere, sometimes due merely to the varying optical properties of air of different temperatures and densities, and sometimes to the presence of an unusual amount of dust, smoke or fine water-drops. Dust-haze, or *dry fog*, is characteristic of dry climates and dry seasons; it is also a result of fires in forests, moors and prairies, and of volcanic eruptions. Remarkable instances of *daytime darkness* have sometimes been produced by exceptionally dense haze of this character.

Moisture in the atmosphere is accountable for a variety of optical phenomena (*photometeors*). Falling raindrops produce, by refraction and reflection, the *rainbow*, opposite the sun. There is usually a bright *primary bow* and a fainter *secondary bow;* and one or both may be fringed with *supernumerary* or *spurious bows*. Lunar rainbows are sometimes seen. They are, as a rule, nearly colorless, owing to feeble illumination. Water clouds produce around the sun or moon, by diffraction, a diffuse reddish ring, called the *corona*. From a mountain top or a balloon a person sometimes sees his shadow cast on a bank of fog or cloud. (The shadow seems "gigantic," owing to over-estimation of its distance.) The head is often surrounded by a *glory* of colored light, due to diffraction. The whole phenomenon is called the *specter of the Brocken*.

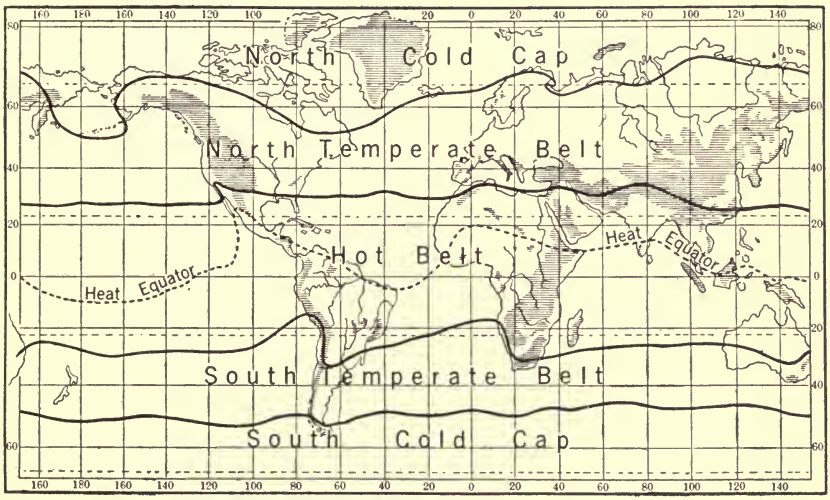


BANDED FORM OF ALTO-CUMULUS

Halos are due to the refraction or reflection (or both) of light by ice crystals in the atmosphere. They may take the form of rings of definite angular size (the commonest has a radius of 22 degrees) surrounding the sun or moon; also of rings or arcs in various other positions, and disks of light (*parhelia* and *paraselenae;* in popular lan-

guage, "sundogs" and "moondogs"). Some forms of halo are distinctly colored; others are not. An excellent descriptive account of such phenomena will be found in the *Monthly Weather Review* (published by the U. S. Weather Bureau) for July, 1914, pages 436-446.

Not all photometeors are due to moisture. *Mirage*, for example, results from the refraction of light through adjacent atmospheric strata having very different densities. One form of mirage is common over hot plains and deserts in calm weather, presenting the illusive appearance of a sheet of water.



TEMPERATURE ZONES (ACCORDING TO SUPAN)

PRECIPITATION

Moisture that is condensed out of the atmosphere and deposited on the earth is called *precipitation*. The commonest liquid form of precipitation is *rain*, and the commonest frozen form, *snow* (each flake of which is an aggregation of tiny ice-crystals). *Hail*, properly so called, falls almost exclusively in connection with thunderstorms, and hence, in our latitudes, is limited to the warm season. It consists of ice and compact snow, generally in concentric layers. Little pellets of snow, like tiny snowballs, falling chiefly in early spring and late autumn, but also in winter, have been inappropriately named *soft hail* (the German name *Graupel* is preferable). The term *sleet* is applied by the United States Weather Bureau to small particles of clear ice—frozen raindrops. The British apply this term to a mixture of rain and snow. Moisture condensed from the air on cold surfaces at night (just as it is condensed on the outside of an ice-pitcher) is called *dew*. If the deposit occurs in a frozen form it is called *hoarfrost*.

Fog drifting against terrestrial objects in cold weather sometimes leaves a rough deposit of ice, called *rime*. The smooth icy deposit due to rain freezing as it falls—often very destructive to tree branches, telegraph wires, and the like—is now officially termed *glaze* in this country, but is popularly misnamed "sleet." In England it is known as

glazed frost. The occurrence of glaze on an extensive scale constitutes an *ice storm.*

In connection with the subject of precipitation passing mention may be made of the widespread delusions that prevail as to the possibility of producing or preventing it artificially. It is held, on the one hand, that cannonading and other explosions cause rain, and, on the other, that the firing of cannon, bombs and rockets drives away hail. Both beliefs are unfounded. The energy involved in such explosions is insignificant in comparison with the atmospheric forces that determine the occurrence of precipitation.

CLIMATE

The meteorological conditions that are characteristic of a particular region constitute its *climate.* With respect to temperature, climates are distinguished not only as hot, cold and temperate, but also as equable and the reverse. Marine climates—i. e., those of regions exposed to winds from the ocean—have small daily and yearly ranges of temperature, while continental climates—those withdrawn from oceanic influences—are subject to great extremes of temperature. The highest temperatures are not limited to the equatorial regions, nor the lowest to the polar regions. Probably no other part of the world experiences quite such hot weather as prevails in the deserts of southern California in summer. A shade temperature of 134 deg. Fahr. has been registered at Greenland Ranch, in Death Valley. Oceanic islands in the torrid zone never have temperatures as high as those that prevail widely over the interior of the United States during "hot waves." On the other hand, the cold weather experienced in winter in our northwestern and north-central States far surpasses anything known in much more northerly seaboard regions of western Europe. The lowest winter temperatures in the world are those that occur in north-central Siberia, where, at Verkhoyansk, an official temperature of 90 degrees below zero, Fahr., has been recorded.

Rainfall, as an element of climate, includes all forms of aqueous precipitation (the frozen forms being expressed in their "water equivalent"). Measurements of rainfall refer to the depth of water that would lie upon the ground if none of it ran off, soaked in or evaporated. Annual rainfalls may be classified, especially with respect to their agricultural significance, as excessive when over 75 inches; copious, 50-75 inches; moderate, 25-50 inches; light, 10-25 inches; desert, under 10 inches. The heaviest rainfall occurs within or near the tropics (though great deserts also occur in this region). The rainiest place in the world for which we have meteorological records is Cherrapunji, a hill station in India, with an annual rainfall of about 426 inches. The heaviest mean annual rainfall in the United States (not including Alaska) is about 133 inches in Tillamook County, Oregon. The heaviest snowfall in the United States probably occurs in the high Sierra Nevada, near the border between Nevada and California. A total depth of 65 feet has been known to fall here in the course of a winter.

That "the climate has changed" within a generation or so is a stubborn popular delusion, which prevails more or less all over the world, and has probably prevailed in every age. The belief in the "old-fashioned winter" is an example of this delusion. More than a century ago American philosophers wrote dissertations on the changes of climate that they supposed had occurred since early colonial times. Such ideas arise chiefly from the fact that exceptional weather impresses itself more lastingly upon one's memory than normal weather.

CHAPTER VI.

THE HEAVENS ABOVE

By C. F. TALMAN

TENNYSON, who, of all the brethren of his craft, did most to poetize the facts of astronomy, speaks of the stars as "cold fires, yet with power to burn and brand his *nothingness* into man." Nonentity has its advantages. A sovereign remedy for the trivial worries of human life is the contemplation of the starlit sky and the realization of the infinitesimal importance of the earth and all things earthly in comparison with a boundless universe. The nightly spectacle of the stars is, however, commonly ignored. Many people look at it all their lives without really seeing it. The more conspicuous constellations ought to be as familiar to every human being with two eyes in his head as the town hall or his next-door neighbor's stable. They are far from being so. Most people you meet will admit frankly that the only constellation they know by sight is the Big Dipper—which, as it happens, is not a constellation at all.

A knowledge of the heavens is more general in primitive and pioneer communities than in centers of civilization and culture. The pastoral tribes of Chaldea and Arabia, thirty centuries ago, were better acquainted with the stars than are modern New Yorkers and Londoners. During the South African war the English soldiers were astonished at the ease with which the colonial troops marched at night, using the stars to guide them in lieu of a compass.

The relative "nothingness" of the earth and its inhabitants is chiefly a modern idea, though it was not entirely unfamiliar to the speculative philosophers of antiquity. Thanks to the brilliant labors of many astronomers—of whom Copernicus should be mentioned first of all—we now know that the world on which we live is a planet or satellite, revolving humbly around an enormously greater body, which we call the sun; and we know that the sun, in its turn, is a rather unimportant member of a vast system of suns, or stars. The sun looks bigger than the other stars only because it is nearer to us.

How many stars are there? Survey the heavens on a cloudless and moonless night, and you will probably get the impression that the number visible to the naked eye is almost infinite. This impression is, however, quite erroneous. The greatest number of stars which the unaided eye can distinguish at any one place on the earth and at any one time is hardly more than two thousand. With an opera-glass many thousands more can be seen, and this little instrument will be found an invaluable adjunct in a study of the heavens. A portable telescope with an object-glass only two inches in diameter discloses, in the entire sky, upwards of 700,000 stars. Great telescopes, such as those

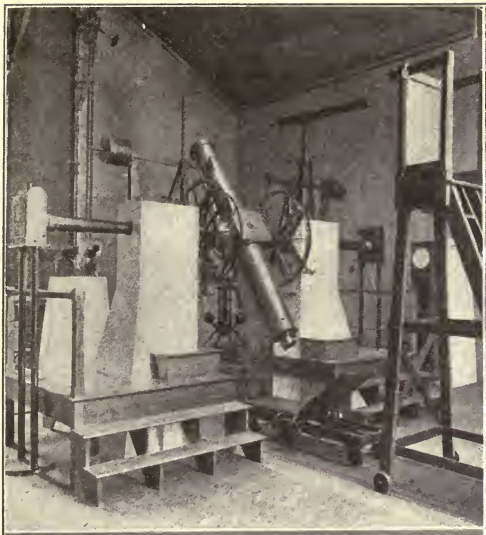
THE ATWOOD SPHERE FOR STUDYING THE STARS

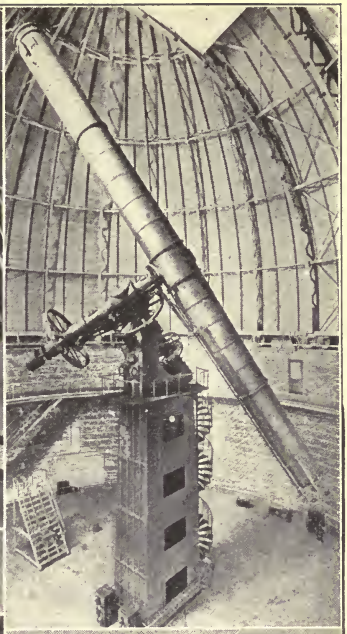
as installed at the Academy of Sciences, Chicago. The stars, down to the fifth magnitude, are represented by perforations, of different sizes, in the sheet iron sphere, through which light shines from the exterior. The sphere can be revolved by an electric motor, making the constellations rise and set.

of the Lick, Yerkes and Mount Wilson Observatories, show at least two hundred million. There are undoubtedly many million more beyond the range of all telescopes on account of their prodigious distances, and there are probably many comparatively near stars that are invisible because they give little or no light. Indeed these dark stars are suspected to be much more numerous than the bright ones. One estimate makes them 4,000 times as numerous; but this is little better than a guess.

The brightness of the stars, as viewed from the earth, is expressed on a scale of "magnitudes," so related to one another that an average star of one magnitude is two and one-half times as bright as one of the next lower magnitude. Of the first, or brightest, magnitude there are only twenty stars; the brightest of all being Sirius, the Dog Star. There are sixty-five stars of the second magnitude, and two hundred of the third. The faintest stars visible to the naked eye on a clear, moonless night are of the sixth magnitude.

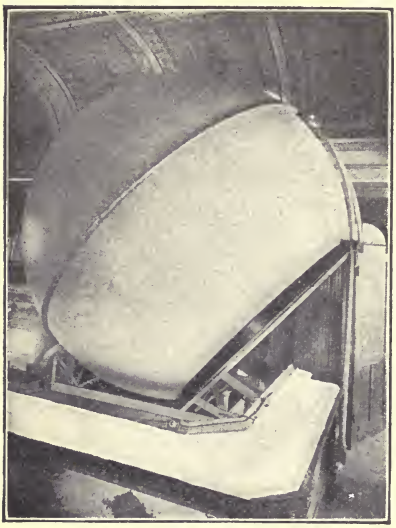
That the astronomer, without leaving our tiny earth, can measure the distances of the heavenly bodies (or at least of many of them) is neither more nor less wonderful than that the surveyor, without crossing a river, can measure the distance of a tree on the opposite bank; though the astronomer's task requires more delicate instruments and more painstaking observations. In both cases quite a simple trigonometrical operation is involved. The surveyor gets the bearing of the tree from each end of a measured base-line; and having thus two angles and one side of a triangle, the rest is easy. In measuring the distance of the moon from the earth, the astronomer uses for a base-line the known distance between two widely separated observatories—say





9-inch Transit Circle
26-inch Equatorial, U. S. Naval Observatory
Washington, D. C.

40-inch Equatorial, Yerkes Observatory
Yerkes Observatory, Williams Bay, Wis.

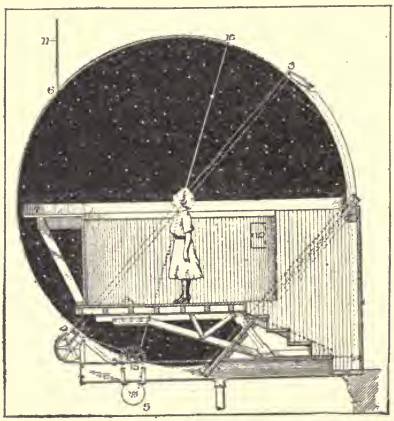


EXTERIOR OF THE SPHERE

at Greenwich and Cape Town—and gets the bearing of the moon, or rather its apparent position as projected on the far more distant background of stars, from each observatory. The difference in the direction of the moon as seen from two places on earth (generally reduced to the difference in its direction from the center and surface of the earth respectively) is known as the moon's "parallax," and gives us the moon's distance—about 239,000 miles. The sun's parallax is found in a somewhat different manner, but the process also involves the use of the distance between two places on earth as a base-line. The distance of the sun from the earth is about 93,000,000 miles. An express train would take more than 250 years to perform a journey of this length, and a cannon ball about nine years. Light, traveling at a speed of 186,000 miles a second, requires a little more than eight minutes to reach us from the sun.

Yet, this distance, enormous as it is, is insignificant compared with the distances of even the nearest stars. In measuring the parallax of a star terrestrial distances are far too small to serve as the base line, and accordingly the star is sighted from two opposite points in the earth's circuit about the sun, giving a base-line one hundred and eighty-six million miles in length. Even so, the base-line is barely long enough to give a measurable parallax for a comparatively small number of stars, and the observations involved are among the most refined known to astronomy. Photographic methods are now employed in measuring stellar parallaxes.

The distances of the stars are so great that to state them in miles would be as awkward as stating the distance from New York to Calcutta in inches. Hence a larger unit is commonly employed, known as the "light-year." This is the distance which light travels in a year, and is a little less than six trillion miles (according to the American and French meaning of the term "trillion," corresponding to the British "billion"). Another unit, more recently introduced, is the "parsec," defined as the distance at which a star's parallax is one second of arc, or 206,265 times the distance of the



MECHANISM OF THE SPHERE

earth from the sun. At a distance of one hundred parsecs our sun would be a star of the tenth magnitude. Our nearest neighbor in stellar space is a star of the southern heavens called Alpha Centauri (the brightest star in the constellation of the Centaur), its distance being 4.3 light-years.

Concerning the actual dimensions of the stars we have little positive knowledge, but it is certain that some are very much larger than others, and that our sun is far from being one of the giants of the universe. To Canopus, a magnificent star of the southern skies, has recently been ascribed by some astronomers the honor of being the biggest of the stars, one estimate giving him a volume about two and one-half million times as great as that of the sun. While such figures are highly speculative, they are not improbable.

What are the stars made of? Before the invention of the spectroscope there appeared to be little prospect that mankind would ever find the answer to this question. The spectroscope is an instrument which analyzes a beam of light, and furnishes certain information concerning the source from which it comes. It spreads out the light into a rainbow-colored strip, called the spectrum. If the source is a luminous gas, the light is broken up into a number of bright lines or bands. If the light, coming from a luminous solid, liquid, or dense gas, has passed through a cooler and less luminous gas, the spectrum as a whole is bright, but is crossed by dark lines or bands. In either case the positions of these lines and bands reveal the chemical composition of the gaseous material.

The interpretation of the lines and bands depends upon laboratory experiments, and the spectroscope is much used by chemists in making analyses; but it is also used, in conjunction with the telescope, by astronomers, to determine the composition, not of solid or quasi-solid bodies in the heavens, but of the gaseous envelopes or atmospheres by which these bodies are surrounded. Both our sun and the other visible stars are so hot that some or all of the substances of which they consist (apart from those which are gaseous at low temperatures) are vaporized, and form such enveloping atmospheres.

The solar spectrum shows that the sun's atmosphere, and hence the sun itself, contains an abundance of calcium, iron, hydrogen, sodium, nickel, and other substances found on earth. About forty terrestrial elements are positively known to exist in the sun, and the presence of others is indicated on less certain evidence.

With the aid of photography the spectra of more than 200,000 stars have been examined. Some show the presence of a few, others of many elements known on earth. The differences between different stellar spectra are, apparently, not due to any radical differences in the composition of the stars themselves, but rather to the fact that their physical conditions differ, especially as to temperature, and hence they have different kinds of atmospheres. In short, the stars, the sun and the earth are probably all made of the same sort of matter.

The stars are frequently described as "fixed," to distinguish them from the planets of our solar system, which, as we shall presently see, change their apparent positions in the sky more or less rapidly with respect to the stars and to one another. Actually, however, all the stars are in rapid motion through space. Our sun, for example, travels at a speed of about twelve miles a second. Many stars move much faster. At the Mount Wilson Observatory one has recently been found with a velocity of about 358 miles a second.

The movements of stars make themselves evident in two ways. In

the course of years certain stars have been observed to change their positions a little with respect to other stars. This change is known as "proper motion," and is always very gradual. The greatest proper motion known is that of a star discovered by Barnard, in 1916, which in about 180 years changes its place in the sky by an amount equal to the apparent diameter of the moon. Proper motion of a star whose distance from us is known by observations of parallax shows how fast the star is moving *across* the line of our vision, i. e., the line extending from our eyes to the star, but does not tell us whether, or how fast, the star is approaching or receding from us. This so-called radial motion, or motion in the line of sight, is determined by means of the spectroscope. The result of such motion is a slight displacement of the spectral lines from their normal positions. Displacement in one direction shows that the star is approaching, and in the other that it is receding; while the amount of displacement indicates the speed of approach or recession.

In general the stars are so far apart that they show no definite effects of one another's attraction, but there are a number of pairs of stars which are obviously revolving around common centers of gravity. These are called "binaries." Among those thus far discovered the periods of revolution range all the way from a few hours to 1,500 years. Some of these pairs are so close that they appear as a single star even in the most powerful telescopes, but their double character is revealed by the spectroscope, and hence they are known as "spectroscopic binaries." If the plane in which the stars revolve lies more or less "edge on" to the earth, each star will, of course, successively move toward and from us in the course of its revolution. This causes a shifting of the spectral lines similar to that mentioned in the last paragraph. If both stars are bright enough to show spectra, the corresponding lines of these spectra will alternately coincide and separate. If only one star shows a spectrum, its lines will shift alternately to right and left. When, in such cases, the parallax of the stars is known, we can compute from well-known laws of gravitational motion the actual dimensions of the orbits in which they revolve and the masses of the stars, notwithstanding the fact that the best telescopes do not show these bodies separately, and may not show one of them at all—a remarkable example of what has been called "the astronomy of the invisible."

Many stars are observed to vary in brightness, either regularly or otherwise. When there is a regular period of variation, the spectroscope generally shows the star to be double, and the variations of brightness are apparently determined by the different aspects presented by the two components during the period of revolution. There is also good reason to believe that some variable stars are not spherical, but are elongated into an elliptical, pear-shaped, or hour-glass-shaped form, and the rotation of such a star might present to us markedly varying amounts of surface. In an interesting class of variable stars known as "eclipsing variables"—of which Algol, the "demon star," is the most famous example—the principal star of a pair is periodically "eclipsed" by the passage in front of it of a less luminous (not necessarily dark) satellite, which is itself invisible in our telescopes. There are still other variables of which the fluctuation in brightness is apparently the result of periodic outbreaks of activity in the star itself, due to causes of which we have no knowledge.

It has occasionally happened that a temporary star has made its appearance in the firmament, and some of these "novæ," as they are called, have been of great brilliancy. The most famous of them was one which

appeared in the year 1572, and which is commonly associated with the name of Tycho Brahe, the Danish nobleman-astronomer, because he wrote a description of it, though he did not discover it. For some days it was brighter than any other star in the sky and visible in broad daylight. It then gradually faded, and at the end of sixteen months had become invisible. Another remarkable nova appeared in the constellation of Perseus in 1901. Two days before its discovery a photograph of that portion of the heavens, showing stars as faint as the eleventh magnitude, did not include it. When first observed, it was of the third magnitude, and it brightened in two days to the first, after which it rapidly faded. It is still visible in the telescope as a star of the twelfth magnitude.

Various explanations of these sudden apparitions have been suggested. The collision of two dark or faint stars in space would doubtless give rise to a great burst of luminosity, or a vast eruption of glowing matter might occur from a star that was previously quiescent (but this is an explanation that needs to be explained). According to a recent hypothesis, supported by spectroscopic evidence, novæ are due to the passage of a normally faint or dark star through a gaseous region in space; the star being made luminous by friction, just as a meteorite becomes luminous in passing through the earth's atmosphere.

Such gaseous regions are known to exist, and many of them are self-luminous, constituting some of the bright cloud-like patches in the heavens known as "nebulæ," two or three of which are faintly visible to the naked eye, while probably half a million or more are within the range of the biggest telescopes, or the camera. Not all nebulæ are gaseous. Many are merely distant clusters of stars, presenting in ordinary telescopes the same appearance as gaseous nebulæ. Whether a nebula is gaseous or not can sometimes, but not always, be determined by the spectroscope.

Photographed by Ritchey, Yerkes Observatory

The Great Nebula in Andromeda — Spiral Nebula

Nebulæ assume various characteristic forms; some are ring-shaped, some elliptical; some (the "planetary" nebulæ) disk-shaped, and almost uniformly bright throughout. Others are quite irregular in shape; of this type is the Great Nebula in Orion, the most magnificent object

of its kind in the sky. This nebula, which can be vaguely seen with the naked eye, surrounds one of the stars in Orion's sword:

"a single misty star
Which is the second in a line of stars
That seem a sword beneath a belt of three"

(a description, by the way, that is probably lost on ninety-nine out of every hundred readers of Tennyson's "Merlin and Vivien"—especially in America, where astronomy has been almost completely banished from schools and academies).

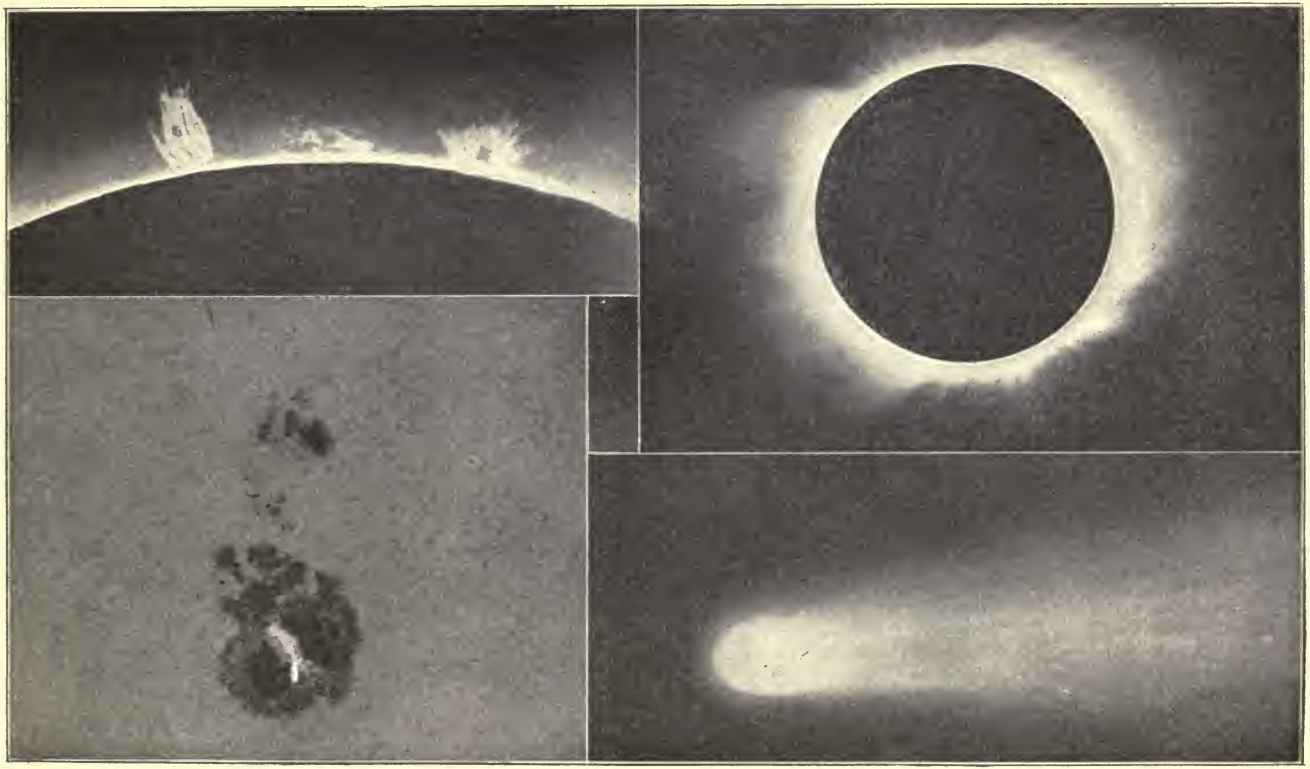
Fine details of the nebulæ which the eye, aided by the best of telescopes, cannot detect are revealed by long-exposure photographs. It thus appears that many, and perhaps most, of them are made up of spirally twisted wisps of light, studded with points of condensation. The camera has also disclosed the presence of faint nebulous matter spreading over great areas of the sky; in some cases enveloping a whole constellation. Just as there are dark stars, so there appear to be many dark nebulæ. It is probable that such objects, silhouetted against a luminous background of dense star fields, account for some of the striking black patches in the sky, once supposed to be merely starless regions of space.

The galaxy, or Milky Way, a great luminous band encircling the sky, presents a nebulous appearance to the naked eye, but even a small telescope shows it to be made up of innumerable stars, from the eighth magnitude down, including many dense clusters. It contains, however, very few gaseous nebulæ. The number of stars in a given area of sky decreases more or less regularly as we move away from the galaxy. Thus it seems likely that the stellar universe, or, at least, the system of stars to which our sun belongs, has a more or less disk-like shape (comparable to that of a thin watch), with the sun and the solar system somewhere near the middle of it. We should see the densest accumulation of stars in looking toward the edge of the disk, and this would correspond with the galaxy.

We have now, in a truly cosmopolitan spirit, taken a general survey of the universe before paying particular attention to the little nook of it in which we live. It is time to say a few words about the solar system.

At the center of this system is the sun; an intensely hot rotating globe, about 866,000 miles in diameter, probably of very dense gaseous matter, completely enclosed and hidden from our view by a shell of clouds, which we call the "photosphere." While our earth has a cool atmosphere, composed of nitrogen, oxygen and other substances that are gaseous at ordinary temperatures, and in which water-vapor is condensed, by cooling, into the droplets and ice-crystals of which terrestrial clouds consist, the sun, on account of its vastly higher temperature, maintains an atmosphere in which even the most refractory elements are vaporized, and its clouds, also liquefied and solidified by cooling, do not consist of water, but of various metals, with carbon and other elements.

The solar atmosphere extends far above the photosphere. Immediately overlying the latter is a gaseous layer, consisting partly and perhaps chiefly of hydrogen, called the "chromosphere." In structure it may be compared to a sheet of flame, for, though we can see the photosphere through it, the chromosphere itself shines with a brilliant scarlet light, which is visible along the border or "limb" of the sun at the time of a solar eclipse. At such times long outward projections from the chromosphere are often seen, and these are called "prominences." With the aid of the spectroscope it is possible to see both the chromosphere and the prominences without an eclipse, and even to photograph



Solar Prominences
Photographed at Eclipse, May 28, 1900. Barnard and R'tchey
Sunspots
Photographed at Yerkes Observatory

Solar Corona
Photographed by Barnard and Ritchey, May 28, 1900
Head of Halley's Comet, May 5, 1910
With 60-inch Reflector, Mount Wilson Observatory

them. Some prominences are quiescent, hanging for days over the same spot, while others may be seen to shoot upward, often at a speed of from 100 to 200 miles a second, and to altitudes which, in extreme cases, amount to from 200,000 to more than 300,000 miles. Lastly, the sun has an extremely tenuous outer atmosphere, of vast extent, which is seen as a broad wispy glow during an eclipse, and is known as the "corona."

The surface of the photosphere usually exhibits a few or many dark patches, of various shapes, known as "sunspots." These vary in size from tiny points, just visible in the telescope, to great blotches that can be seen, through smoked glass, with the naked eye, and are actually 100,000 miles or more in diameter. The spots are transient phenomena, lasting from a few days to a few months, and changing more or less rapidly in shape. As the sun rotates, carrying the spots with it, the latter appear at one limb of the solar disk and travel across to the opposite limb. The spots look like holes in the photosphere, and were formerly believed to be, at least, deep depressions in its surface; but they are now regarded as the tops of vortices, or cyclones, in the solar atmosphere. This atmosphere is undoubtedly the seat of an active circulation, analogous to the wind-system of the earth, and one consequence of the circulation is that the cloud layer, or photosphere, rotates much more rapidly near the solar equator than elsewhere; viz., once in about twenty-five days, as compared with thirty days and upwards in high solar latitudes.

The temperature at the surface of the sun far exceeds the highest that can be attained with the electric furnace, the most powerful heating device known to man. Estimates range up to 16,000 or 18,000 deg. Fahr. The sun's output of heat has been the object of elaborate observations with instruments, such as the bolometer and the pyrheliometer, designed for measuring the minute fraction of this heat that we receive on earth, and it is found to be subject to slight fluctuations; yet in

SATURN, THE LIGHTEST OF THE PLANETS IN PROPORTION TO ITS SIZE, WOULD FLOAT IN WATER (IF THERE WERE AN OCEAN BIG ENOUGH TO HOLD IT!)

RELATIVE SIZES OF PLANETS
(Sun's Diameter on Same Scale Equals Length of Cut)

Corrected to date from Todd's "New Astronomy." Copyright 1897 and 1906. Used by permission of American Book Company, publishers.

the long run it remains substantially uniform, and probably has so remained since prehistoric times. How is this supply of heat maintained? The impact of meteors falling with enormous speed into the sun would account for part of it, but the much slower fall of the outer portions of the sun itself—in other words, a gradual shrinking of the whole body —seems to be the chief explanation. It has been computed that a contraction of only six miles per century would keep the sun at its present temperature. Several centuries must elapse, however, before this slow shrinking, if it exists, can be verified with the telescope.

The student who has familiarized himself with the constellations and their principal stars with the aid of star maps will notice in the nocturnal sky a few star-like objects, some of them very brilliant, which are not shown on the maps, and which move from one constellation to another. Their paths all lie within a comparatively narrow zone of the heavens, called the "zodiac." These are the planets. Compared with the stars and the sun they are actually of very small size, though some of them outshine any of the stars because of their proximity to us. The nearest of all the planets does not shine in our skies; it lies at our feet. We call it the earth. There are eight known planets; not counting their attendant moons, or satellites, nor the small bodies known as asteroids, or planetoids. All the planets, with their moons, and also the asteroids, revolve around the sun in orbits that, in most cases, are nearly circular. They all shine with light reflected from the sun.

The names of the planets, the order in which their orbits lie from the sun, and their relative sizes are shown by the accompanying diagram, the total length of which indicates the diameter of the sun, on the same scale. The satellites, not all of which are shown, are not drawn

to scale (those of Mars would be invisible if their relative size were not here much exaggerated). Mercury is the nearest planet to the sun. Though there has been much speculation about an "intramercurial planet"—it has even been given the name Vulcan—no such body is now believed to exist. On the other hand, it is extremely probable that one or two unknown planets lie beyond the orbit of Neptune.

Besides revolving around the sun, each planet rotates on its axis. The

TELESCOPIC VIEW OF THE MOON A DAY AFTER FIRST QUARTER

The image is inverted as compared with a naked eye view. The rough edge to the right is the "terminator"—the line along which the sun is just rising. Here the craters cast long shadows and are most favorably observed

rotation of the earth causes the, to earth-dwellers, apparent daily revolution of the sun, moon and stars, just as the motion of a train in which you are riding causes the apparent motion, in the opposite direction, of objects outside the windows of your carriage.

The moons or satellites have even more complex motions than the planets. They are carried by the latter around the sun; they rotate on their axes; and they revolve around the planets to which they severally belong. Mercury and Venus have no moons; the earth has only one; Mars has two, both very small and very close to the planet. At this writing (1916) Jupiter is known to have nine, Saturn ten, Uranus four, and Neptune one; but it is not likely that all the satellites of these four planets have been discovered.

Our own moon—*the* moon—is much the nearest of all celestial bodies to the earth. Her diameter is a little more than one-fourth as great as the earth's, and she revolves around our planet in about twenty-seven and one-third days. The lunar "month," determined by the relative positions of the moon and sun in our skies, is twenty-nine and one-half days. Since the moon always keeps the same face toward the earth, she turns once on her axis while she is revolving once around the earth.

The moon is usually described by modern astronomers as a "dead planet." She is supposed to have had an atmosphere ages ago, but to have lost it, and to be devoid of moisture and incapable of supporting life. All that is certain, however, is that if a lunar atmosphere exists it is excessively rare, and that most, if not all, forms of life known to us would perish if transplanted to our satellite. Some recent observers, notably Professor Pickering, believe they have detected patches of vegetation and ice, frost or mist on the lunar surface. The moon is the most interesting of all objects in the telescope, because of the innumerable mountains —chiefly extinct volcanic craters— which cover her surface. Many of the craters are far larger than any similar formations known on earth. Several hundred of the craters have been named in honor of early astronomers and philosophers. The so-called "seas" on the moon are desert plains—perhaps the dry beds of former oceans.

The gravitational pull of the moon, combined with that of the sun, produces the tides in our oceans. As the earth rotates, a wave of water travels around the globe, following the direction of the moon's apparent motion, while another wave, on the opposite side of the globe, is due to the fact that the earth itself is pulled, by the moon's attraction, away from the overlying ocean. Thus at any one place in the ocean there are two tides a day.

In her revolutions around the earth the moon frequently passes between us and the sun, in such a position as to obscure the whole or a part of the sun's disk as seen from portions of our planet, producing a solar eclipse. As the direction of the moon at any time with respect to the sun is not the same from all parts of our globe, an eclipse that is "total" in one region of the earth will be "partial" or *nil* in other regions. At any one place "totality" is very brief, lasting only three or four minutes in an average eclipse. There is a very narrow zone along which totality occurs progressively, as the moon advances in her orbit and the earth rotates (these two motions are in the same direction, otherwise the duration of the eclipse would be even less); on either side is a much broader zone, in which a partial eclipse is seen; while over the rest of the earth there is no eclipse.

A lunar eclipse occurs when the moon, in the course of her revolution, passes through the shadow cast by the earth, and is thus temporarily

deprived of sunlight. If the moon is completely immersed in the shadow the eclipse is total; if only partly immersed, it is partial. A lunar eclipse, unlike a solar eclipse, is always visible to the entire hemisphere of the earth turned moonward at the time.

Mercury and Venus are called "inferior" planets, because their orbits lie within that of the earth. As viewed from the earth they seem to oscillate from one side of the sun to the other; now appearing in the western sky after sunset, and now in the eastern sky before sunrise. Mercury's apparent position in the sky is never very far from that of the sun, and hence this planet is never above the horizon long enough after sunset or before sunrise to be conspicuous. Venus moves considerably farther from the sun, and at such times becomes a magnificent object, much brighter than any other planet or fixed star. It is probable, though not certain, that Mercury and Venus always keep the same faces turned toward the sun, just as the moon does toward the earth. If so, scorching heat must prevail perpetually in one hemisphere of each planet, while intense cold reigns in the other. Mercury appears to have little or no atmosphere; but Venus gives unmistakable evidence of possessing one, and also clouds. As to permanent surface markings on these planets astronomers are not in agreement.

The "superior" planets, i. e., the planets whose orbits are outside that of the earth, sometimes lie in the same direction from the earth as the sun, when they are said to be in "conjunction" with that luminary, and are invisible; sometimes in the opposite direction, when they are said to be in "opposition," and shine through the night, rising about sunset and setting about sunrise. Positions midway between conjunction and opposition are known as "quadrature."

Mars, when at opposition, and therefore nearest the earth, is an object of great interest on account of the many details of its surface that can then be seen through powerful telescopes, under favorable atmospheric conditions. These markings show that the planet rotates on its axis once in about twenty-four and one-half hours; hence its "day" is a little longer than the earth's. Near the planet's poles are two white patches, the "polar caps," which behave as if made of snow or ice, varying in size with the Martian seasons. The rest of the surface is mottled with grayish green and yellowish areas, and shows a number of dark lines and spots that have been variously reported and interpreted by different observers. Among these are the so-called "canals," described as radiating and intersecting lines of such geometrical regularity as to suggest an artificial origin. Many double or twin canals have also been reported. One hypothesis in regard to these lines is that they are irrigation channels, fringed with vegetation. This implies, of course, the present or former existence of intelligent beings on Mars. Some astronomers, however, consider the canals a mere optical illusion, due to the tendency of the eye to join up by lines any aggregation of small or faint markings.

Beyond the orbit of Mars lie the asteroids, or minor planets, of which several hundred are known, while many new ones are discovered every year. The largest of these bodies is barely 500 miles in diameter, and most of them are very much smaller.

Next in order comes the giant planet Jupiter, one-tenth as great in diameter as the sun, around which it revolves in a period of nearly twelve years. Jupiter turns on its axis once in about ten hours; faster than any other planet. As in the case of the sun, we see little if any of its real surface, but only a dense layer of clouds in which it is enveloped. These clouds assume belt-

like forms, visible even in a small telescope. The planet itself is believed to be in a fluid or semi-fluid condition, and intensely hot, though hardly hot enough to be luminous. Jupiter is the second brightest of the planets, and much brighter than any fixed star.

Saturn, which lies next beyond Jupiter, is unique among the planets in the possession of a system of flat and very thin rings, like circular disks of paper perforated in the middle. According to the position of the planet with respect to the earth and the sun the rings present very different appearances, and at times disappear altogether, at least in ordinary telescopes; viz., when they are "edge on" to us, or "edge on" to the sun, or, again, when they turn toward us the side on which the sun is not shining. At other times they are broadly elliptical and conspicuous in a small telescope. These strange appendages were long a puzzle to the astronomers, but are now known to be made up of innumerable little bodies, comparable in size to meteors, revolving around the planet. Saturn exhibits cloud-belts, like those of Jupiter, though less distinct, and its structure is probably similar to Jupiter's.

Uranus is barely visible to the naked eye. It was the first planet to be found with the telescope, having been discovered in 1781 by Sir William Herschel, who at first supposed it to be a comet. All the planets with which men were then acquainted had been known from antiquity, and the discovery of a new one created a great stir. Much more remarkable, however, from a scientific point of view was the discovery of Neptune, in 1846. The position of this planet was computed before the planet itself was seen, solely on the basis of irregularities in the movements of Uranus, which were evidently due to the disturbing influence of another and undiscovered member of the solar system. The computations were performed independently by Leverrier in France and Adams in England, and the planet was found by the astronomers at the Berlin Observatory at the place where Leverrier told them to look for it. Neptune is invisible to the naked eye. Its distance from the sun is 2,791,000,000 miles, and its "year," i. e., its period of revolution around the sun, is 165 of our years. It has therefore not made half a circuit since its discovery, in the days of our grandfathers.

Comets, once objects of awe and terror, are commonplace to the modern astronomer, who, with his telescope, finds half a dozen new ones every year. About one-fifth of these become, at some time in their history, bright enough to be seen with the naked eye. While many comets, especially the fainter ones, have no visible "tails," a few have displayed more than one of these appendages. The tail is always directed away from the sun, and often attains a stupendous size; some have been more than 100,000,000 miles in length. Most astonishing is the fact that, in spite of their size, comets are always excessively light; mere feathers compared with any of the planets. This is proved by the fact that they do not produce the slightest disturbance in the movements of planets or satellites near which they pass, though their own movements are greatly modified by these approaches. Comets are self-luminous, but their brightness is doubtless increased by reflected sunlight. Many of these bodies are permanent members of our system, performing their revolutions around the sun at intervals of a few or many years. Others, so far as we know, make this circuit only once, and then dash away for all time into outer space.

Meteors, or shooting stars, appear to be intimately related to comets, and may be produced, at least in part, by the distintegration of the

latter. These bodies only become visible to us when they pass through our atmosphere and are made luminous by friction. Millions of them enter the atmosphere every day. Most of these are probably vaporized and dissipated, some pass on into space, and some reach the earth as meteorites. Vast swarms of meteors appear to be constantly traveling in regular orbits around the sun.

The "zodiacal light," a faint glow extending along the zodiac in both directions from the sun, and best seen in our latitudes in the evenings of February and March, is probably due to sunlight reflected from a great ring of meteors.

CRATERS ON THE MOON

Large-scale photograph of a small section of the lunar surface. The prominent crater near the middle of the picture is Bullialdus. Near the left margin is the formation known as the "Straight Wall."

THE NORTHERN HEAVENS

The maps shown on the following pages represent the heavens as seen, on the different dates given, from stations in and about the latitude of New York (40° N) It is not an easy matter to recognize the stars by looking at the map. A certain amount of study is necessary: for, of course, the different stars of a constellation are not linked together by lines as they are in the map and furthermore their magnitude is very much exaggerated. The best plan for the novice is to start with a well known constellation, such as that of the Great Bear. The "Dipper" which is a part of the Great Bear is so conspicuous a group in the northern skies that anyone can point it out. Knowing the Dipper. the Pole Star may readily be discovered by tracing a line from β through α of the Dipper and about five times as far. Around the Pole Star (Polaris) which is of the second magnitude, the entire northern heavens appear to revolve once a day. Having found the Pole Star the constellation of Cassiopeia may be found by extending a line from ϵ of the Dipper through the Pole Star and as far again to the other side, where a cluster of stars in the form of a large ragged *W* will be found. If we run a line diagonally from α of the Dipper through γ and about eight or nine times as far again, we shall come to the first magnitude star Spica, in the constellation of the Virgin, while a line extended from α through β and about eight times as far again will bring us in the midst of the constellation of the Lion. At the eastern end of this constellation, is the second magnitude star Denebola, and the distance from this star to Spica is about the same as that from Spica to Arcturus, the first magnitude star in the constellation of Boötes. Thus we may proceed building up our knowledge of various groups and using these groups as reference points to find new constellations.

Contrary to custom in geographical maps, our star maps are drawn with the east on the lefthand side and the west on the righthand side, while north is at the top of the page and south at the bottom. This is due to the fact that the heavens are viewed looking upward, while the geographical map is viewed looking downward. In locating stars and constellations, it is best to hold the map overhead when the actual points of the compass and those marked on the map will bear the true relation to each other.

THE "DIPPER" AS AN INDEX TO THE HEAVENS.

NIGHT SKY: JANUARY AND FEBRUARY

If one views the heavens on the hours specified under our map of January, he will find almost directly overhead a bright star with a triangle of lesser stars beside it. The bright star is Capella or the Little She Goat which is held on the arm of Auriga, the Charioteer, whose left hand is represented by the triangle of stars, η, ϵ, ζ. The constellation bears no resemblance whatever to a charioteer or a goat. In fact, very few constellations bear any resemblance to the objects the ancients supposed them to represent. Halfway between Capella and the southern horizon are the three bright stars forming the belt of Orion: They are indicated in the map ζ, ϵ, δ, and they are centered in the square formed by the stars, Betelgeux, Bellatrix, Rigel and the star noted by the letter κ. The little triangle of stars at λ mark the head of Orion, while the line of faint stars at π represents a lion skin that Orion is holding forth towards the constellation of Taurus, the Bull. The principal star of this constellation is Aldebaran, a bright red star, marking the left eye of the bull, while his two horns are indicated by the stars β and ζ. The star ϵ is at the right eye of the bull, and γ at his nose. They form with Aldebaran a triangle that is easily recognizable. A little to the west of this group is the interesting star cluster of the Pleiades. In this cluster, there are six stars easily visible to the naked eye, and many can see seven stars, while observers with exceptionally good eyesight have been able to see as many as fourteen stars. A small spyglass will reveal large numbers.

The stars forming the belt of Orion point in the general direction of the first magnitude star Sirius in the constellation of Canis Major, the Great Dog. Sirius is by far the brightest object in the heavens if we exclude the sun, moon and planets. It is one of the nearest suns outside our solar system, yet it is so far off that it takes nearly nine years for its light to reach us. The diameter of Sirius is about twenty times that of the sun and its volume is about seven thousand times greater. In the constellation of Canis Major there are

At 11 o'clock: Jan. 7
" 10:30 " " 14
" 10 " " 22

At 9 o'clock: Feb. 6
" 8:30 " " 14
" 8 " " 21

At 9:30 o'clock: January 29

NIGHT SKY: JANUARY AND FEBRUARY.

two other first magnitude stars, but Sirius so far outshines them that they look no brighter than second magnitude stars. If we follow the line from Aldebaran eastward beyond ζ we come to the constellation of Gemini, the Twins, marked by the two bright stars, Castor and Pollux; while south of this constellation is the first magnitude star Procyon in the constellation of Canis Minor, the Little Dog. It will be noticed that most of the constellations so far referred to lie adjacent to the Milky Way. If we follow the Galaxy northward, we find just beyond the constellation of Auriga, the constellation of Perseus, whose most interesting star is marked β and is known as Algol, the Demon Star or the Winking Demon. Every two days, twenty hours and forty-nine minutes, this star begins to fade until, in the course of three or four hours, it loses four-fifths of its light. Then it begins to become brighter until eventually, after three or four hours more, it reaches its normal brilliancy. The star marks the head of Medusa, which, according to the Greek legend Perseus was carrying when he came across Andromeda chained to the rock. Further north along the Milky Way we come to Cassiopeia.

In the northeast is the great dipper forming part of Ursa Major, the Great Bear; far in the east is the constellation of Leo, the Lion, in which are the prominent stars Regulus, Denebola. The curved line of stars ending with Regulus is known as the Sickle.

At	11	o'clock	Mar. 8	At	9	o'clock	Apr. 7
"	10:30	"	" 16	"	8:30	"	" 14
"	10	"	" 23	"	8	"	" 22

At 9:30 o'clock: March 30

NIGHT SKY: MARCH AND APRIL.

Our map for March and April shows most of the constellations along the Milky Way low in the western sky. The great dipper is well up near the zenith with its pointer stars β and α indicating the position of the Pole Star, Polaris. Oddly enough the ancients represented the great bear as having a long tail, indicated by the stars ϵ, ζ, η. These are the only stars that follow the outline of the beast. The star o is at the bear's mouth, while the stars κ, ι, and μ, λ, and ν, ξ represent three of his feet. The star ζ is interesting because it has a small companion, called by the Arabs "Alcor." A little to the south of the zenith is the constellation of Leo, referred to in the previous paragraph. Below Leo are two small groups known as Corvus, the Crow, and Crater, the Cup. They are not very conspicuous; neither is Hydra, the Sea Serpent, which stretches its long length across the southern sky. Its brightest star is Alphard which is of the second magnitude. Above the head of the serpent is the inconspicuous constellation of Cancer, the Crab. An interesting feature of this constellation is a faint star cluster, just visible to the naked eye and marked on the map Praesepe, the "Beehive." In the telescope this is seen to be made up of a myriad of small bright stars.

At 11 o'clock: May 7
" 10:30 " " 15
" 10 " " 22

At 9 o'clock: June 7
" 8:30 " " 14
" 8 " " 22

At 9:30 o'clock: May 30

THE NIGHT SKY OF MAY AND JUNE.

The constellation nearest the zenith in May and June is that of Boötes, or the Herdsman. A bright red star, Arcturus, may be found in this constellation. It is known as the Wandering Star for the reason that it is slowly drifting with respect to the other stars in the Heavens. Since the time of Christ it has moved in a southwesterly direction, fully one degree, or through a distance equal to twice the diameter of the moon. Its yearly displacement is two seconds of arc. South of Boötes is the constellation of Virgo, whose brightest star is Spica. Between Virgo and Ursa Major are two faint constellations known as Coma Berenices, Berenice's Hair, and Canes Venatici, the Hunting Dogs. Close to the southern horizon is the constellation of Centaurus, the Centaur. Not very much of this constellation can be seen from our latitude. Its brightest stars lie below the horizon. They include α Centauri, the nearest body outside the solar system. This star is only 255,000 times as far from us as we are from the sun. It takes its light $4\frac{1}{3}$ years to come to us. In the southeast, low down near the horizon may be seen the constellation of Scorpio, the Scorpion. This constellation is made up of a very easily recognizable group of stars. It contains the brilliant first magnitude star, Antares, at each side of which are the lesser stars σ and τ. A line of stars traces the form of the Scorpion as shown to better advantage in the next map. The Scorpion embraces in its claws the constellation Libra, or the Scales. In the north above the Polar Star, we may see

the body of the Little Bear, Ursa Minor. Most of the stars of this constellation are faint with the exception of Polaris and two stars β and γ which have been called the guards. Between Ursa Minor and the Zenith, the constellation Draco, or the Dragon, twines its long form. The stars γ, β and ξ mark the head of the dragon. To the eastward of the constellation Boötes is a partial ring of stars known as Corona, or the Crown. This is one of the few groups actually outlining the object it is supposed to represent.

At 11 o'clock: July 7
" 10:30 " " 14
" 10 " " 22

At 9 o'clock: Aug. 7
" 8:30 " " 14
" 8 " " 22

At 9:30 o'clock: July 30

NIGHT SKY: JULY AND AUGUST.

The Zenith constellation for July and August is Lyra, the Lyre, with its bright blue-white star, Vega, nearly directly overhead. Just west of the Zenith is the constellation Hæroules whose stars form a ragged-looking *H*. Below this constellation is Ophiuchus who has in his grasp the constellation Serpens or the Serpent. Low down in the south the constellation of Scorpio has dragged its full length above the horizon and it is easy to trace its body and tail ending with the stars λ and ν. The opposite side of the Milky Way now stretches its length across the sky, containing in its extent many brilliant constellations. Just east of Scorpio is the constellation of Sagittarius, the Archer. Well up in the southeast is the star Altair of the constellation Aquila, the Eagle, and just above Altair is the tiny constellation, Sagitta or the Arrow. To the east may be seen Delphinus, the Dolphin, while to the east of Lyra is the constellation of Cygnus, the Swan.

At 11 o'clock; Sept. 6
" 10:30 " " 14
" 10 " " 21

At 9 o'clock: June 7
" 8:30 " " 14
" 8 " " 22

At 9:30 o'clock: September 29

NIGHT SKY: SEPTEMBER AND OCTOBER.

Our map for these two months shows no constellation immediately overhead. Halfway between the Zenith and the Pole Star is the constellation of Cephus, a badly formed *W* made up of stars that are not very bright, with the exception of α which is of second magnitude. The Milky Way now stretches overhead and makes a beautiful sight on a moonless night. About thirty degrees south of the Zenith is the constellation Pegasus. Its three stars, γ, α, and β form with the star α of the constellation Andromeda, a large square known as the "Square of Pegasus." Below the constellation Pegasus is that of Aquarius, the Water Bearer, while to the southwest is the zodiacal constellation of Capricornus, the Sea Goat. This constellation is marked by a very pretty naked eye double at α. The most conspicuous star in the south is Fomalhaut, of the Southern Fish. This brilliant star can hardly be appreciated in northern latitudes because it is not very favorably placed for observation. Below Fomalhaut is a bright little group known as Grus, the Crane.

At 11 o'clock: Nov. 7
" 10:30 " " 14
" 10 " " 22

At 9 o'clock: Dec. 7
" 8:30 " " 15
" 8 " " 23

At 9:30 o'clock: November 30

NIGHT SKY: NOVEMBER AND DECEMBER.

Running westward from the zenith stretches the constellation of Andromeda, the chained lady who was rescued by Perseus. In this constellation may be seen a faint nebula which in a telescope is shown to cover an enormous extent, a great whirl of nebulous material Probably it represents a star in the making. The great square of Pegasus lies just to the south of the zenith. The southern sky is filled by the constellation of Cetus, the Whale. The most interesting star in this group is that of Mira, which on the average of once in eleven months, blazes forth with a brilliance, sometimes exceeding the second magnitude Generally, however, it does not exceed the third magnitude, while its normal brightness is such that it is barely visible to the naked eye. Between Cetus and the zenith are three small constellations, *i. e.*, Pisces, the Fishes, Aries, the Ram, and Triangulus, the Triangle. In the southeast sky is the wandering river, Eridanus, while the eastern sky is filled with brilliant winter constellations described in the paragraph on the January and February map

WHEN UNCLE SAM'S WHISTLE BLOWS

The total number of persons in the legislative, executive and judicial services of the Federal Government on July 1, 1915, was approximately 488,711. The total number of officers and enlisted men in the Army, Navy and Marine Corps is 172,618

PART III.

UNCLE SAM'S AUTOBIOGRAPHY

CHAPTER I.

WASHINGTON—THE NATION'S CITY

YOUR city is the most beautiful capital in the world. There are those who sing the praises of London, Paris, Vienna, Berlin, Rome, Petrograd, and all have claims well substantiated. But in plan, architectural beauty, embellishment, cleanliness, convenience, absence of poverty, spaciousness, interest, educational facilities—in all that makes a city noted above other cities, Washington, the Nation's City as well as the Nation's Capital, stands unique and unapproachable.

THE GATEWAY—WASHINGTON'S MAGNIFICENT UNION STATION

Most American of all cities, since it is owned by the Nation's Government, it is not less patriotic that it is the one spot in all free America where people are taxed without representation in the taxing body, governed without their consent, and made to stand by and look on at the spending of their money without a word to say (officially) as to how it shall be spent. And—strange though it seems in American eyes—this plan of the National City being taxed and governed by the National Government has resulted in the wonderful municipality which is peerless among all cities.

A Mecca for the sight-seeing tourist, Washington is still more a meeting place for those who pursue knowledge, for no spot on earth holds so much of learning for those who know how to dig it out. It has been well said that in Wash-

ington is the answer to any answerable question—and some which have no answers, too!

Considered as a municipality, entirely apart from governmental activities, Washington can hold up its head among the best. In streets, parks, and shade trees, in recreation centers, police, fire and school systems, in privileges and pleasures, Washington is behind none of its size and ahead of many larger cities. It has a minimum amount of crime, a comparatively small indigent and poverty-struck population, no foreign quarters, a climate which suffers more from ill-repute than Washingtonians do from its warm summers, a just and liberal Government, no graft, party politics or factional fights, and, because it lives in and among the greatest law-making body in the world, a better comprehension of national problems than is possible elsewhere.

PANORAMA OF WASHINGTON

CITY GOVERNMENT

Three commissioners, one of whom must be a major in the Army Engineering Corps, appointed by the President and confirmed by the Senate, act as a combined Mayor and City Council for the District of Columbia's seventy square miles of territory, having charge of all departments of the local government. Washington is taxed as other municipalities are taxed, but the money is spent by Congress, which adds a sum sufficient to make that raised by taxation exactly half of the total appropriated for any one year. In return for this "half-and-half principle" as it is known, all Government property—and the Government, of course, owns the most valuable land and buildings in the city—is free of taxation. The result of a wise and liberal policy of city improvement has been the making of a municipality with more shade trees in proportion to its population (95,000 trees) than any other in the world, a city with a greater percentage of paved streets per population than any other in the world, a city with wider streets, straighter streets, cleaner streets than any other in the world, and the establishment of a parking system which

will, when completed, be the eighth wonder of the world for beauty, size and variety.

THE CITY PLAN

The original plan of the city contemplated its growth in an easterly direction across the plateau which forms the top of Capitol Hill, on the summit of which stands the United States Capitol.

The city perversely grew the other way, so that the wealthy residence and all the business section, and practically all the Government buildings and activities, are west of and therefore to the rear of, the Capitol. Luckily, the rear elevation of the Capitol is as beautiful as its actual front.

From both the Capitol and the White House radiate four great avenues, distinguished from other streets by running at an angle with the gridiron which forms the city. Washington's north and south streets are numbered, those running east and west are lettered. The avenues, named for states in the Union, all run at various angles.

The city is divided into four sections—Northwest, Northeast, Southwest, and Southeast, the division lines being North, East and South Capitol Streets, and an imaginary line running through the park known as the Mall, which would be West Capitol Street if it existed.

Criss-crossing these streets, in addition to the eight spokes of avenues radiating from the Capitol and White House, are other slanting arteries of travel, confusing to the visitor, but making every part of the city quickly accessible from every other part to those who know how to take advantage of those hypothenuses of triangles. At junction points of lettered and numbered streets and avenues are parks, circles, or statues, productive of those vistas and beauty spots which have

THE HEART OF THE NATION

given the city the "pet name" of "City of Magnificent Distances."

PARKING SYSTEM

Five great parks of many acres, twenty-six of more than one acre and two hundred and seventy-five smaller ones (not including the great military reservation at Fort Myer, Virginia, just across the river, and connected by a bridge with the Speedway), constitute a parking system which has no equal in the world. Splitting the heart of the city east and west from Capitol Hill to the Potomac River is the Mall, a wide park on which are located (mentioned in order from the Capitol, going west) the Bontanical Gardens, the Fish Commission, Medical Museum, old National Museum, new National Museum, Smithsonian Building, old Department of Agriculture Building, two wings of the new Department of Agriculture Building, Washington Monument, and Lincoln Memorial (not yet completed). The Mall gives way to the Speedway, a river park made from reclaimed land, where there is swimming and boating and baseball, golf, tennis, polo and cricket grounds are to be found, band concerts occur and thousands of pedestrians, motorists, horseback riders and drivers have a place close to the heart of the city in which to enjoy their favorite recreations.

WHERE AN INAUGURATION IS HELD, AND THE PROCESSION

North of the Northwest Section is the National Zoo, where nearly 1,500 animals of all sorts have comfortable and beautiful homes, in many cases in natural surroundings. Connected to the Zoo is the National Park, a reservation devoted entirely to natural recreation. Far-seeing statesmen recognize the need of all cities for ample parking space, and beautiful Rock Creek Valley has been preserved for all time to the Nation, nothing being done to it but the providing of miles on miles of velvet

roads and necessary bridges and fords. The combined area of Zoo and National Park is 1,776 acres.

North of the Capitol and east from the National Park lies Soldiers' Home Park, a beautiful hilly country with many fine roads, where the Nation maintains a magnificent home for its disabled soldiers.

Plans now under way contemplate the connection of Zoo and National Parks with the Speedway and Mall, by driveways along the unimproved

WASHINGTON MONUMENT, WASHINGTON, D. C.

part of Rock Creek Valley, a plan which, when complete, will enable a motorist to drive for five or six hours without going over the same road twice, or even running on a city street, and yet be at no time more than a few miles from the center of the Nation—the United States Capitol.

GOVERNMENT BUILDINGS

They are so numerous that a complete catalogue would be wearisome. The visitor usually makes first for the Capitol, on Capitol Hill, where he also finds the indescribably wonderful Library of Congress, the two huge office buildings devoted to the use of Senators and Representatives, the Union Station—second to none in the world in beauty, and with a concourse capable of housing the entire standing army of the United States—all in an extension of the Mall.

The buildings on the Mall have been mentioned; in addition, just off the Mall and giving on the Speedway is the new Bureau of Engraving and Printing, the largest plant of its kind in the world.

The White House, or Executive Mansion, stands between the Treasury and State, War and Navy Department Buildings, fronting on Pennsylvania Avenue, and giving to the rear on the "Ellipse," a part of the Mall.

In the heart of the city are the Post Office, Pension Office, Land Office and Patent Office buildings (this latter the office also of the Secretary of the Interior) and scattered everywhere are related branches of the several departments. On the outskirts of the city are the United States Naval Observatory, where, among other things, is the great 26-inch refractor with which the moons of Mars were first seen, the Bureau of Standards, and further out, the first settling reservoirs of Washington's wonderful water supply system, which includes a filtration plant which provides crystal water regardless of the mud which may be in the Potomac.

All Government buildings may be visited by visitors prior to two o'clock, and no charge is made anywhere.

Any official in the Government, from the President down, may be seen by any one with legitimate business, and every facility is put at

the disposal of him who seeks information by every department of the Government, with the exception of those necessarily restricted by their very nature—such as Army and Navy and Secret Service.

There are many buildings, bureaus and activities which are wholly or partly separated from the Government. The National Geographic Society, the City Library, the Volta Bureau, the Bureau of American Republics, the stupendous Scottish Rite House of the Temple, the hospitals, schools, colleges, universities, private laboratories, Carnegie Institute, etc., all add to the educational possibilities of the city.

A dozen or more interesting localities surround the Nation's City. The Navy Yard, where the big guns are made, the Arsenal Grounds, with the War College, St. Elizabeth, the home of the Nation's insane, Columbia Institution for the Deaf and Dumb, Continental Hall (D. A. R.), Corcoran Art Gallery, Mt. Vernon, Washington's Home, Annapolis, where they turn out Naval officers, Great Falls, wild and rugged in beauty, source of the city water supply and historic in that George Washington dug a canal around them, the remains of which are still to be seen, beautiful Harper's Ferry, historic in Civil war days and magnificent in scenic beauty, Baltimore, forty miles distant by road or rail, Alexandria, Arlington (home of the Lees, and now the National Burying Ground) are all within an hour and a half of the Capitol, some within a few minutes' travel, while Norfolk and the Newport News shipyards are but a night's boat ride away.

Photo Harris & Ewing

THE "OPEN DOOR" AT THE WHITE HOUSE

Visitors not infrequently ask the length of time necessary properly to see the Nation's City. The resident, who knows, usually answers, "Not less than a year," and there is truth in the statement.

Indeed, those who are thoroughly familiar with the great national col-

SCOTTISH RITE TEMPLE AT NIGHT

lections say that a year is hardly enough really to see, let alone study, the wonders of either the Museum or the Library of Congress.

So to those who may find in this brief sketch or the pictures which accompany it, any impetus to visit that city which is most truly American, and which belongs in part to every American, it is said, "Stay as long as you can and do not think that a visit to every Government building in Washington, which could not possibly be accomplished in a week, means that you have really seen the treasures which are yours. For Washington, belonging to the Nation, is its treasure house, and collected, kept, and made accessible here are such treasures of age, of curiosity, of interest, of educational value, of patriotic association, of real Americanism, as will require more time to see and appreciate than any have time to give—which fact is in itself one of the many things which makes the Nation's

THE STATUE TO DAGUERRE

City an inspiration and an example of all that is best in the ideals which make the United States "one nation indissoluble."

THE CORCORAN ART GALLERY

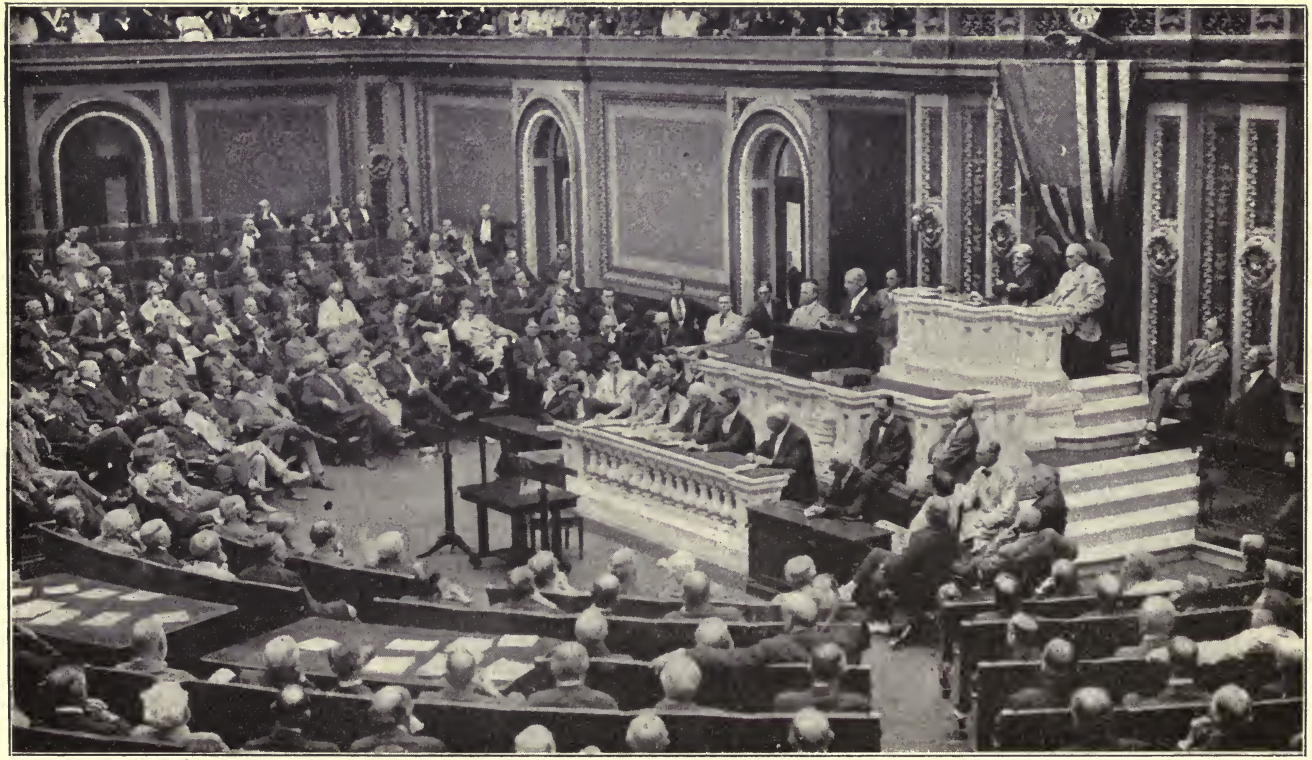


Photo Harris & Ewing

THE PRESIDENT ADDRESSING A JOINT SESSION OF THE SENATE AND THE HOUSE OF REPRESENTATIVES ON THE RAILROAD QUESTION. SUCH SESSIONS ARE RARE

CHAPTER II.

THE LEGISLATIVE HALLS

THE HEART OF THE NATION

THE United States Capitol Building is the political and sentimental center of the United States, however far removed it may be from the geographic center.

Fronting east, it stands on a plateau 88 feet above the level of the Potomac, situated in latitude 38° 53′ 20.4″ north and longitude 77° 00′ 35.7″ west from Greenwich.

The southeast cornerstone of the original building, constructed of sandstone taken from quarries on Aquia Creek, Va., was laid with Masonic ceremonies September 18, 1793, by President Washington. The original designs were prepared by Dr. William Thornton, and the work was done under the direction of Stephen H. Hallet, James Hoban, George Hadfield, and B. H. Latrobe, architects. The north wing, finished in 1800, and the south in 1811, were then connected by a wooden passageway! On August 24, 1814, the interior of both wings was destroyed by fire, set by the British. But the

Photo by Harris & Ewing

THE CAPITOL AT WASHINGTON

damage was immediately repaired and in 1818 the central part of the building was begun, under the architectural superintendence of Charles Bulfinch and was completed in 1827. Up to 1827 the total cost of building and grounds was $2,433,844.13.

The cornerstone of the extensions was laid on July 4, 1851, by President Fillmore, with Daniel Webster officiating as orator. Thomas U. Walter directed the work till 1865, when he resigned, and it was completed under the supervision of Edward Clark. White marble from value is probably far below the actual cost of replacement.

The building stretches from north to south 751 feet 4 inches, and from east to west 350 feet is its greatest dimension. The area covered by the building is 153,112 square feet, more than 3.7 acres.

The original dome was of wood, covered with copper, but this was replaced by the present structure of cast iron in 1865. With the bronze statue of Freedom on top, 19 feet 6 inches high, the total weight of the dome is 3,983 tons. The dome

Photo Harris & Ewing
THE SENATE CHAMBER IS NEVER PHOTOGRAPHED IN ACTION, THEREFORE HUMAN INTEREST IS LACKING IN THIS PICTURE

the quarries at Lee, Mass., was used in the walls and the columns came from quarries at Cockeysville, Md. The House extension was first occupied for legislative purposes December 16, 1857, and the Senate January 4, 1859.

The Capitol Building and Grounds are officially valued as follows: Building, $15,000,000; grounds,.$10,-400,000; total $25,400,000. But the is 287 feet 5 inches above the base line of the east front and 217 feet 11 inches above the top of the balustrade of the building. Its greatest diameter at the base is 135 feet 5 inches. The dome surmounts and covers what is known as the Rotunda, a circular room 97 feet 6 inches in diameter, and is 180 feet 3 inches high from the floor to the top of the canopy.

The three great Government activities housed by the Capitol are the Senate, House of Representatives and the Supreme Court.

The United States Senate Chamber is located in the left wing of the Capitol, or, as is better known, the North Wing. It has seats, of course, for the ninety-six senators who compose the Senate—two from each State regardless of size or population—and is surrounded with a gallery, in which more than a thousand spectators can find seating place.

The room, 113 feet 3 inches long by 80 feet 3 inches wide and 36 feet high, is chaste, almost severe in architectural design (see picture), although the iron and stained glass ceiling gives a touch of color with the coat of arms of each State.

The Senate is entirely too dignified a body ever to permit itself to be photographed, but is free in its welcome of visitors. The galleries are always open except when the Senate is in Executive session, when even the reporters', diplomatic and senators' private galleries are emptied and locked.

Arranged in a succession of semicircles, the senators' individual desks are all within sight and voice-reach of the chair of the Vice-President, who presides over the Senate. Democrats sit on the Vice-President's right, and Republicans on his left, a general statement which hardly holds good when the Senate is in session, because senators move around, talk from every point of vantage or sit with their friends.

Ordinarily no one is permitted upon the floor of the Senate save present and ex-legislators, the pages who serve them with books, carry messages and run errands, such clerks and officials as are a part of the official life of the Senate and representatives of certain newspapers and press associations. Only when the "Thanks of Congress" have been given to some fortunate individual is this rule abrogated, the "Thanks of Congress" carrying with it the right to enter the Senate Chamber on the floor. But both houses of Congress extend the privilege of the floor to distinguish visitors at their pleasure.

Directly opposite, in the South Wing of the Capitol, is the House of Representatives, where the 435 members of the House have their deliberations. It is similar in arrangement to the Senate, but is much larger, being 139 feet long, 93 feet wide and 36 feet high. Its galleries will seat more than 2,000 people. The House has not space to provide each member with a desk; indeed, if the country keeps on growing and the House keeps on in its present way of thinking, it will not be able to provide all its members with seats in a short while. As every one knows, the House itself fixes the population of a district which shall entitle that district to one representative, but to increase the population quota with regard to the increase in the total population only, would be, for instance, to increase New York's representation and decrease that of some western States not growing so fast, or some eastern States, like Delaware and Rhode Island, which naturally grow more slowly, though as fast in proportion, as larger States.

The House is generally admitted, even by itself, to be unwieldy in size, now that it possesses 435 members, exclusive of the delegates from non-contiguous possessions. What it will be when a new census is taken and a new apportionment made, no one can say. Meanwhile, semi-circular rows of seats serve the members apparently as well as do their desks the senators. For no member gets a chance to make a speech of such length as will require voluminous notes, reports and books, speaking time being the most precious possession in the House. In the Senate, where any senator who can get the floor can speak until dumb from throat paralysis, a desk capable of holding a good-sized slice of the Con-

gressional Library—with which the Capitol is connected by a subway with electric book carrying trains—is a vital necessity.

No place in the world has a greater interest to the public than the National Legislature of the United States. Two hundred and fifteen newspapers and press associations have 304 representatives to the press galleries of both houses, and a majority of these are on duty every hour of every session of Congress. Of course, during executive sessions, all newspaper men are excluded, but as many of the press representatives make it their business to have intimate friends among the members of Congress, there is little if anything which is really secret. Indeed, both Congress and the President trust the newspapers far more than is generally realized, and it is a credit to the profession that what should be kept under cover for diplomatic reasons, is concealed, not because of absence of knowledge on the part of the correspondents, but because of loyalty and patriotism.

THE CONGRESSIONAL LIBRARY

It would be idle to discuss whether the Senate, the House of Representatives, or the President of the United States is the most important factor in its government. Clothed by the wisdom of the founders of the Republic and those who wrote the Constitution with unique and widely different powers these three branches of the Government operate in unity and serve as a check upon each other.

The Senate and House of Representatives, forming together the Federal legislature, commonly called Congress, are entirely dissimilar bodies. The House of Representatives lives for only two years, then dies completely, a new House being formed by the biennial election of the 435 Representatives of the people of the various States.

The Senate never dies; it has been a continuous body since its first creation. Senators are elected for six years, but a senatorial election is held every two years, one-third of the members of the Senate going out of office biennially. The result of this system is that a majority of the Senate is always composed of older and experienced members. Inasmuch as many Senators are re-elected, term after term, there is always a large proportion of men of ripe experience and long service in the upper house of Congress.

Any variety of legislation with one important exception can originate in either branch of Congress. Appropriation bills can only originate in

the House of Representatives, but no appropriation bill can become a law until it is concurred in by the Senate.

No bill of any sort, whether originating in the Senate or the House of Representatives, becomes a law until it has been to the President for his signature. He is supposed to return these bills to Congress within ten days. If he signs the bill it becomes a law; if he fails to sign in ten days a bill automatically becomes a law. If, however, the President returns a bill *vetoed*, that is, with his signature refused, it is required that the bill be passed again by both Houses of Congress *by a two-thirds majority* before it can become a law.

This is equivalent to giving the President the power to vote in the negative, in theory at least, of seventy-two Representatives and fifteen Senators.

If a bill be passed in the House of Representatives by a bare majority of one of the 435 members it will receive 218 votes in the affirmative against 217 in the negative. If, however, the President vetoes the bill, it will require 290 votes to pass it, 290 being two-thirds of 435. The difference between 218 and 290 is 72, the theoretical voting power which the President possesses in the House of Representatives.

In the Senate, the bare majority of the 96 Senators is 49 and a two-thirds majority necessary to pass a bill in the Senate over the President's veto is 64, the difference being 15 Senators, representing the theoretical power of the President in vote in the Senate.

Methods of work in Senate and House are entirely different. There is no attempt in the Senate to limit the speaking of a Senator on any subject. He, therefore, can talk as long as he desires and a "filibuster," as it is called, when some Senator or group of Senators desires to defeat a bill by talking it to death, or talking until Congress expires, or until its opponents are so disgusted that they will yield to the "filibuster," is not of infrequent occurrence. No such procedure is a possibility in the House. In the House debate is limited by the rules or by mutual agreement to a certain length of time.

When a bill is introduced into the House, it is immediately referred to some committee. There are fifty-

Photo Harris & Ewing

STATE, WAR AND NAVY BUILDING, WASHINGTON, D. C.

nine committees in the House and seventy-five in the Senate. In addition there are a number of joint committees.

The two most important committees in the House are those on Ways and Means, and Appropriations, and membership in either is a mark of confidence by the House. The House elects the Ways and Means Committee, which acts as a Committee on Committees, and it appoints all the other committees. Chairmanship of a committee is a matter of seniority of service in the House.

No legislation gets to the floor of the House for the discussion of the

POST OFFICE DEPARTMENT BUILDING

House as a whole except as referred to the House by the committee or by unanimous consent. Therefore, the committee is extremely important to all legislation and nine out of ten of the thousands and thousands of bills of all kinds, which are proposed in the House, are quietly strangled in committee and never see further light.

Inasmuch as many such bills are proposed merely for "home consumption" and in order to make an impression on the "folks back home," this system works out without hardship either to the Representative proposing the bill, the bill itself, or the House of Representatives as a whole.

The committee, the members of which may be anywhere from three to twenty in number, will debate a proposed bill, hold public hearings for the benefit of interested parties, make amendments to it, and finally offer it, perhaps in a completely changed form, back to the House for consideration. The House can then pass it or reject it at its pleasure. Having succeeded in passing the House, such a bill goes to the Senate and the Senate can then either pass it or reject it. In the more common cases a bill passed by the House which is not entirely pleasing to the Senate is revised or amended by the Senate and then sent back to the House. In case it is impossible for the two branches of the Legislature to agree upon a bill, a Conference Committee is appointed, usually of three members of each House, which Conference Committee meets and endeavors to effect a compromise and the compromise bill is frequently passed without further debate by both Houses of Congress.

No story of the House of Representatives would be complete which did not contain a few words of reference to the most powerful figure in the House, who is, of course, the Speaker. The Speaker at one time appointed the members of all committees, including that of the Committee of Rules, which determines the order in which important measures shall come before the House. In the old days he was himself chairman of this committee, but, in 1910, the House took this power away from its Speaker. It increased the Committee on Rules from five to ten and agreed that the House itself should make the appointments.

This has shorn the Speaker of his previous power but he still has plenty left. He can recognize or refuse to recognize any member trying to address the Chair and can thus accelerate or retard the passage of any bill.

The fact that the House elects usually as its Speaker a national figure in politics and a man of great force of character as well as of brains is one of the safeguards of the national legislature. He is, of course, invariably elected by a strict party vote, a Democratic House of Representatives becoming the more powerful as a Democratic organization by possession of a Democratic Speaker, the same obtaining for a Republican House.

The wisdom of our forefathers in providing for a Senate, composed of two men from each State, representing the States, and not the people, to act as a check upon the Representatives of the people in the House of Representatives, is continually made manifest. The Senate acts often as a brake upon the too headlong action of the House and many an ill-considered piece of legislation, enacted with insufficient debate, and, perhaps, in the heat of partisan feeling in the House, has been so altered in the Senate that its originators could not recognize it when it finally came back to them.

The final bulwark of the people against wrong action on the part of the National Legislature is the Supreme Court, which must pass upon the constitutionality of disputed enactments; and with first a committee, next a House, then a Senate, then, perhaps, a joint committee, again an action by both House and Senate, a possible veto, a re-enactment over that veto and finally possible review by the Supreme Court, as to the admissibility of legislation under the Constitution of the United States, that law must be ingenious indeed which is unjust or ill-advised when finally read into the Statutes of the United States.

SUPREME COURT

If the Senate feels its dignity to such an extent as never to yield to the blandishments of the press photographer or motion picture director, what must be said of the Supreme Court? To imagine this body permitting itself to be photographed is an impossibility. Of course, there are plenty of photographs showing the Supreme Court in session, but none of them are real. All are made by combining pictures of the various justices with an interior of the Court; a real photograph has never been made.

The Supreme Court room was formerly the Senate Chamber. Until 1859 the Senate met in the present Court room, the Court then sitting in the room beneath, which is now the Law Library. It is a simple and impressive room even when unoccupied, and when the Court is in session no American can look upon its deliberations unmoved, for it represents to him the very apotheosis of the democracy on which his nation is built, the justice and liberty which make America, America.

As every American knows, the Supreme Court is the one branch of the Government which has absolutely no connection with politics, with patronage, with partisan methods of any kind. Justices, appointed for life, can only be removed for high crimes or misdemeanors, and no justice ever has been removed since the Court was founded. Presidents with Supreme Court vacancies to fill have all realized that the American people would scrutinize their appointments with the keenest eyes, and let the Senate know in no uncertain manner if they did not approve. The result has been a continuing body which represents the highest legal and personal attainments, and one which, although it often makes decisions which are unsatisfactory to many people, is never questioned as to its integrity by its most violent critics.

An appointment to the Supreme

Photo Harris & Ewing

UNITED STATES SUPREME COURT

Bench is justly regarded as exceeded in honor only by the Presidency, and many contend that as the one is a permanent appointment, the other but a temporary position, the nine Supreme Court Judgeships represent the nine highest honors America has to offer. Certain it is that no man who has sat on the Supreme Bench has ever lacked for appreciation from his fellow citizens, or honor from them for the high attainment which put him there.

The Court sits from October to June, from noon until 4 P. M., five days in the week, reserving Saturday for consultation. Strangers are permitted to visit the court at all times, although accommodations are limited.

PANORAMA OF WASHINGTON TAKEN BY TELE-PHOTO LENSES FROM THE NATIONAL CEMETERY AT ARLINGTON, VA.

THE PRESIDENT DELIVERING THE INAUGURAL ADDRESS

CHAPTER III.

THE PRESIDENT—THE EXECUTIVE

THE real functions of the President of the United States are, curiously enough, comparatively little understood by the body politic. He is usually referred to in conversation as being the equal of any prince, potentate, czar or other ruler of the monarchies or other forms of government which obtain in Europe.

As a matter of fact, the President of the United States has executive powers which, in many ways, are considerably less in extent than those possessed by many a prime minister of a European country and decidedly less power than many

Photo Copyright by G. V. Buck, Washington, D. C.

EXECUTIVE STAFF OF THE WHITE HOUSE

monarchs. On the other hand, the President of the United States enjoys certain privileges and powers not possessed by even the rulers of absolute monarchies.

The three principal functions of the President may be stated as a control of foreign relations, those powers which are concerned with legislation, and those which relate to the domestic administration, the latter largely concerned with the matter of appointments and patronage, particularly in the appointment of members of the Supreme Court.

The President has a practically unfettered initiation in regard to all foreign affairs, but is checked in his control of the foreign relations of the United States by the Senate, which must approve by a two-thirds majority all treaties negotiated with a foreign country through the Department of State for the President.

While the power to declare war belongs entirely to Congress, it is perfectly possible for an Executive, without an act of Congress, virtually to engage in hostilities. An example of this is recent within the public mind in the expedition sent across the Mexican border. A somewhat similar case occurred in 1845 when the Mexican war began without any initiative by Congress.

A question frequently asked of those who know, and especially by new Congressmen who come for the first time to the great legislative halls upon Capitol Hill, is "What is the form of the President's power over Congress? By what means does he bend this immense legislature representing the forty-eight States and the hundred million of people, to his will?"

The answer to this question is extremely complicated if taken up in detail, but in its broad essentials the control of the President over Congress may be stated to lie in four great things. In the first place, there is that political unity of a party which means so much to the politician. Supposing that the President has a majority in Congress (and few Presidents have made much headway without it), the Congress is naturally desirous of appearing before the country as supporting and aiding the President in his work. The President then has the political power of his party behind him in any request which he makes of Congress or any suggestions which he gives them.

Photo Harris & Ewing

TELEGRAPH ROOM, EXECUTIVE OFFICES, WHITE HOUSE

This more or less sentimental consideration, however, is probably of less avail than the three great prerogatives which the President has. These are, of course, the power of vetoing legislation passed by Congress, which does not meet his views, the power of calling an extra session of Congress and the power of making numerous appointments, many of which serve as "payments" for political work or for something done for the President by some Congressman or Senator.

The veto is employed a hundred times in a veiled threat to once in actuality. More than one Senator or Representative has been quietly told, perhaps by the President, more likely by some friend, that this or that particular bill has no opportunity to pass *unless a two-thirds majority can be mustered.* This threat of the veto is usually sufficient to keep undesirable legislation from passage. Every Senator and Representative knows that the people of the United States hold the President responsible for the conduct of the Government and are usually with him, right or wrong. Senators and Representatives know that when a bill is vetoed, they will have to explain and explain pretty promptly to their constituents just why they are right and the President is wrong if they are going to, to use a slang phrase, "get by with it."

It has sometimes been suggested by some members of Congress who did not want legislation desired by the White House to pass, that by making an agreement to end the session of Congress on such and such a day and so arranging matters that the objectionable legislation did not come up, the President might be circumvented without an open break.

Older members, however, know that the Congress has power only to *end* its deliberation. The President has the power, guaranteed under the Constitution, of calling a special session at any time when it may be necessary to do so.

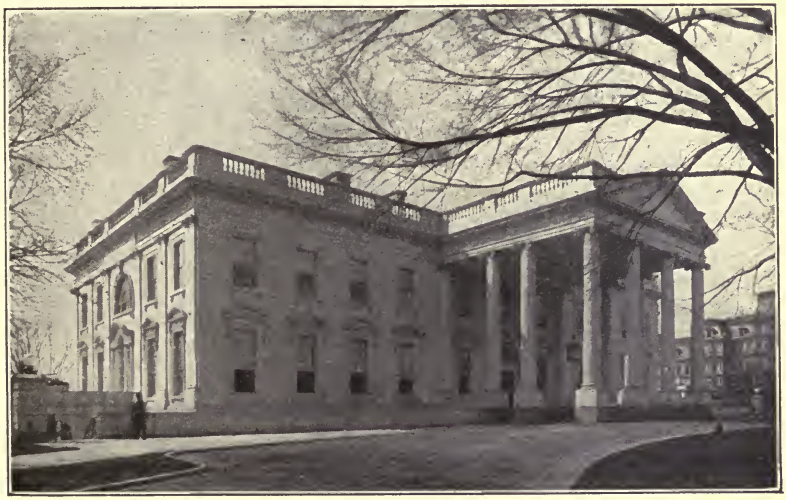


Photo Harris & Ewing

THE WHITE HOUSE—HOME OF THE PRESIDENT AND CENTER OF WASHINGTON'S SOCIAL ACTIVITIES

More than one President has informed a Congress, anxious to end without passing legislation which he deemed necessary, that if it did so, a special session would immediately be called. Here again is the necessity for the legislator to explain to his constituents just why there is an extra session! The majority will not believe the President called a special session of Congress without a reason therefor and the question most naturally arising is "What is that reason?" If it had to be explained to the people that Congress has been negligent or has been attempting to pass over its responsibilities and failed to support the President, there is naturally apt to be fireworks at the next Congressional election.

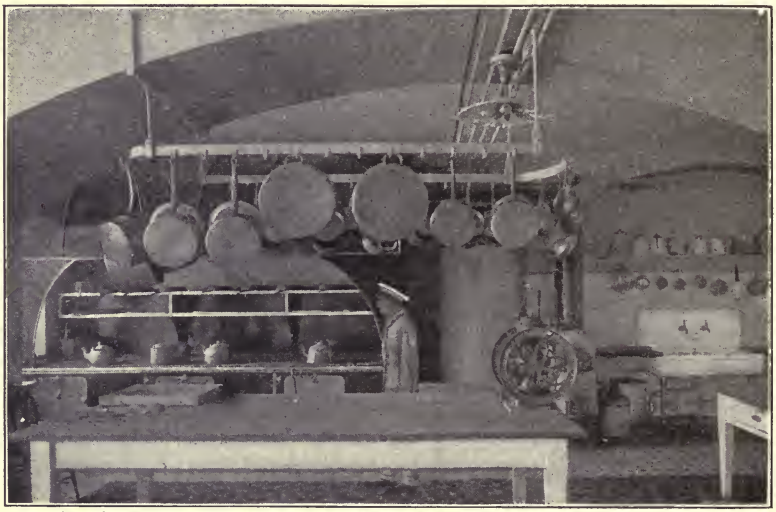


Photo Harris & Ewing

THE WHITE HOUSE KITCHEN IS LARGE ENOUGH TO PROVIDE FOR LARGE BANQUETS

The appointive power of the President has its drawbacks. Thousands who want jobs either try to see the President personally, or try to have "a friend" see him in their behalf. So great have office seeking calls on his time become that recent Presidents have ruled that they positively would not see office seekers. Mr. Wilson has gone even further and refuses to discuss patronage matters with Senators, Representatives or politicians. Unquestionably, all Presidents have had to break their rules at times, but generally this refusal has served to give them much time for the public business which would otherwise be wasted. Most Presidents refer officer seekers to heads of departments and thus lift from their shoulders a burden none the less great that it is concerned with minor matters.

Of course, the office seeker still dogs the President's door and many who, as one quaint wit expressed it, "also *want to* serve who only stand and wait" are still to be found in the White House. But if such an office seeker gets the President's ear he is apt to find a chilly atmosphere when he gets to the real reason for his visit.

While it is true that the President has no powers over Congress save such as are conferred upon him by the veto, the extra session call, appointments and the opinion of the people of the United States, it may nevertheless be said that his control of the Government is more absolute than his strictly legal powers might presuppose. More and more is this single man being considered by the American people as its Government, and less and less is it holding Congress responsible for the conduct of that Government.

If it were not for the provision which makes it necessary for the Senate to concur in Presidential appointees to the more important positions at his disposal he would be invested with a much vaster power than he actually is. Nevertheless, a tremendous quantity of Federal patronage is within the gift of the President and it is by the use of this patronage that he is frequently able to swing Congress into line with desired enactments, which are thus known as "executive legislation."

As a matter of fact, the President has no power to introduce any bills into Congress. He can merely indicate to Congress by messages what his desires, opinions or feelings are in regard to any immediate legislation. But practically, having at his disposal Federal patronage which is of value to many Senators and Representatives, he frequently can obtain the introduction of such bills or push through such legislation as may seem to him to be good.

Photo Harris & Ewing

THE FAMILY LINEN IS WASHED IN THIS LIGHT AND AIRY LAUNDRY

It will sound strange to many ears but the so-called Cabinet of the United States has no legal existence. The cabinet ministers of England are an integral part of the Government. The cabinet officers of the United States are but the heads of the several departments.

True, there is nothing in the Constitution or any law which restricts the President from making such free choice as he may desire of those

gentlemen who stand at the head of the several great departments of the Government, but when they are called into conclave to advise with the President, they have no power whatever save as personal friends, giving their advice and opinions in matters which he may submit to them.

An exception should be noted to the restricted powers of the President when a state of war exists. At such a time the Presidential power immediately swings to its maximum. As commander of the Army and Navy and charged with the welfare of the Nation, in time of war his powers may exceed those vested in any other ruler in any country.

The American people have an immense reverence for the position of Chief Executive of the Nation, and any man who obtains that office is at once invested by all Americans with an authority and a dignity far beyond that of any other ruler.

Republicans, Democrats, Progressives, Prohibitionists, Socialists, men of every party and political faith, unite in support of the President in matters which concern the welfare of the country, and to this patriotic feeling and belief in the integrity of the holder of the Presidential office can be found the root of that power which the President enjoys in time of national stress.

The only way in which a President can be removed from office is by the process of impeachment. This process is a prerogative of the House of Representatives. An impeached President is tried by the Senate sitting as a court with the Chief Justice of the Supreme Court of the United States presiding. Only one President of the United States has ever been impeached, Andrew Johnson, and the impeachment was not sustained.

In addition to advising with the Cabinet officers in regard to the con-

Photo Harris & Ewing

THE PRESIDENT'S ROOM AT THE CAPITOL
Rarely used except at the end of a session

duct of the business of the United States Government, the President has a busy time with foreign relations. He must not only appoint all ambassadors and ministers to foreign countries, but he receives the Ambassadors of foreign countries to this nation and deals directly with those representatives of foreign governments and rulers. He has an enormous official and personal correspondence, the greater part of which, of course, is handled in a routine manner by a large force of clerks in the White House.

Photo Harris & Ewing

THE PRESIDENT SIGNING THE SAN ANTONIO BILL, MAKING IT LAW

There are a number of unwritten laws in regard to the Presidency, most of them more honored in the breach than in the observance. One is to the effect that the President of the United States should not leave the United States during his term in office, a thing, however, which has been done.

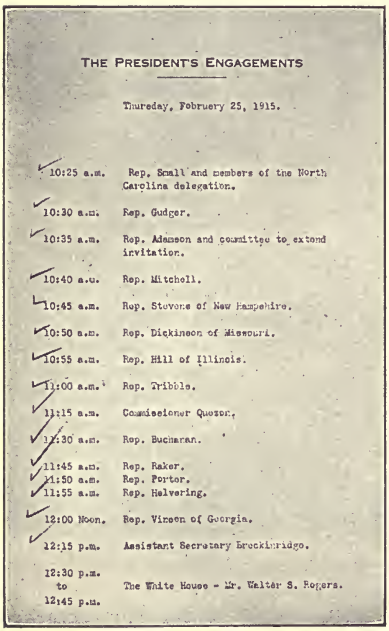
Another concerns the election of a President for more than two consecutive terms, a feat which has not yet been accomplished, but which has threatened on more than one occasion and may yet become a fact. There is nothing in the Constitution or the laws of the United States to forbid the continual re-election of one man to the Presidency.

Still a third unwritten law is that popular opinion that the President must necessarily attend to business in the White House. A President is entitled, by lack of any restrictions to the contrary, to live in any part of the United States he desires and cannot be compelled by any power, other than that of public opinion, to remain in Washington or attend to business! He can take a vacation every day in the year if he wants and no one can call him to account save the House of Representatives by impeachment proceedings.

The President of the United States is an extraordinarily busy man. Just how busy it is almost impossible for the uninitiated to appreciate.

While it is perfectly possible for

any citizen of the United States who has business with the President to see him, it is not possible for even a Senator or a member of the Cabinet to walk in upon the President uninvited. It is necessary for any one having business with the President to make an engagement in advance. At the beginning of every business day a slip of paper headed "The President's Engagements" is laid before the President showing



THE PRESIDENT'S ENGAGEMENTS

Thursday, February 25, 1915.

10:25 a.m.	Rep. Small and members of the North Carolina delegation.
10:30 a.m.	Rep. Gudger.
10:35 a.m.	Rep. Adamson and committee to extend invitation.
10:40 a.m.	Rep. Mitchell.
10:45 a.m.	Rep. Stevens of New Hampshire.
10:50 a.m.	Rep. Dickinson of Missouri.
10:55 a.m.	Rep. Hill of Illinois.
11:00 a.m.	Rep. Tribble.
11:15 a.m.	Commissioner Quezon.
11:30 a.m.	Rep. Buchanan.
11:45 a.m.	Rep. Raker.
11:50 a.m.	Rep. Porter.
11:55 a.m.	Rep. Helvering.
12:00 Noon.	Rep. Vinson of Georgia.
12:15 p.m.	Assistant Secretary Breckinridge.
12:30 p.m. to 12:45 p.m.	The White House - Mr. Walter S. Rogers.

exactly what he has or his secretary has agreed he shall do with his time. Such a Presidential engagement slip is reproduced herewith, and shows that from 10:25 A. M. to 12:45 P. M., which is shortly before lunch, the President has engaged to see and talk with sixteen different people.

As a matter of fact, twenty-four hours is all too short for any President to get through the hundreds of routine and thousands of official matters which require his attention daily. No President has ever abused the confidence of the American people. All have been extremely hard-working men who took vacations and laid down their work only when their health absolutely required it. For the job of being President of the United States is perhaps the hardest individual piece of work which any man can possibly do and the reward of $75,000 a year and $25,000 for traveling expenses is far smaller than the responsibility of the position should demand. When it is considered that there are several men in this country drawing a salary of one million dollars a year or more for commercial work and any number of railroad presidents and presidents of corporations whose salaries exceed that of the President of the United States, it can well be understood how the principal emoluments of the office of Chief Executive are found in the honor and glory of directing the destinies of the greatest nation in the world, and not in any material reward which the position may bring.

Outside the White House, the person of the President is always guarded with Secret Service attendants. If he goes to the theater —which the present occupant of the White House does often—he has, of course, his own box. Somewhere near are the Secret Service men, who precede him to the box and watch it from the rear and from the audience. If the President goes automobiling, a huge Secret Service car with U. S. S. S. on the rear, follows him. When out on the high-road, no car passes the Secret Service car and the White House car from the rear. If the President happens to want to travel at fifteen miles an hour, he may come into the city at the head of a procession of a hundred cars, all of them anxious to pass, but none of them able to get by the Secret Service car, the crew of which is taking no

chances with the crank who might annoy, or worse, the President of the United States.

The public reception—a relic of days when visitors to the Nation's Capitol were few and far between—is one of the trials of a President's life. He must learn to be more than expert in his greeting, or he will have a hand and arm incapacitated for work by the too cordial grasps of his admirers. Indeed, often in small receptions to a visiting delegation or convention, attendants will quietly pass the word and request all visitors to be careful not to grip the President's hand hard. Perhaps no President who ever shook hands with five thousand people in an afternoon had this matter down to a finer science than President Roosevelt, whose method of shaking hands left the visitor nothing to do but grin and bear it; the firm and sudden grip was, of course, self-preservative.

The President, nominally the head of Washington society, has little time for gayety, and the White House is not normally the scene of entertainment. Of course, official receptions to the Cabinet, and to members of Congress and to the Diplomatic Corps are necessary and frequent occurrences, but as a rule our Presidents have been too busy to indulge in those formal and elaborate functions more characteristic of older countries than one which is largely built on the idea of the value of time.

The President of the United States, in addition to his numerous duties as Chief Magistrate, finds time to be also President of the American Red Cross, *ex-officio* President of the Washington National Monument Society, patron *ex-officio* of the Columbia Institution for the Deaf, a Member of the Smithsonian Institution, Chairman of the Arlington Memorial Bridge Commission and member of the Commission on Memorial to Women of the Civil War.

THE WHITE HOUSE

No nation in the world with any pretensions to size or importance houses its king, potentate, emperor, czar or president as poorly as the United States provides for its Chief Executive, and probably not until the Executive Mansion or White House crumbles to dust or burns to the ground will this condition be remedied. No President likes to say that what was good enough for Washington and Lincoln and McKinley is not good enough for him. President Roosevelt had the courage to add two wing-like structures to the White House, the one for the accommodation of visitors at the great White House receptions, the other to accommodate executive offices, clerks, files, etc., but with this exception the White House stands to-day what it has been for many years, a residence not comparable in size, beauty, convenience or utility with a dozen private residences in the Capitol City and thousands throughout the land.

Built of Virginia freestone, and painted white since 1814 to conceal the marks of the fire which destroyed it when the British worked their will with the then struggling capital, the White House is to-day what it has always been—a two story structure but 170 feet long and 86 feet deep. It is beautiful with the beauty of simplicity; designed by James Hoban from the home of the Duke of Leinster near Dublin, it has architecturally satisfying lines, and the great portico with Ionic columns is not unimpressive. Moreover, the house is modernized inside, and has, of course, all modern conveniences of light, heat, ventilation, convenient kitchens, laundries, garage, servants' quarters, etc. But the fact remains that it is a relic of an age when the Government of the United States was on trial, when the tide which receded from the pomp and royalty of the mother country ran far up on the shores of simplicity and plain living, and that

Photos Harris & Ewing

State Dining Room

The East Room

Garden Façade

The President's Desk

THE WHITE HOUSE

it is all out of keeping with the wonderful buildings now being constructed for the Government, and built by it for its own use in times past. It is almost laughable to think of a two million dollar memorial to Lincoln—who so loved simplicity—and a shelter provided for the existing chief magistrate which would be dear at almost any price!

The White House is beautifully situated in extensive grounds, with a private and fenced-in park of its own to the rear as well as in front, in which are to be found many shade trees, plants of all sorts, fountains, a tennis court, etc.

The White House is open to visitors at certain times, and any one can see the President who has a real reason for wanting to see him. But he is well guarded from annoyance or the mere seeker for sensation, and no one gets to him without running a gauntlet of guard, and clerk and secretary.

PRESIDENT WILSON'S CABINET

Three members of the Wilson Cabinet have never appeared before in a Cabinet picture, as this is the first one taken since long before former Secretary Bryan resigned. They are Secretaries Baker, Lansing and Gregory. From left to right around the table: President Wilson, William G. McAdoo, Secretary of the Treasury; T. W. Gregory, Attorney General; Josephus Daniels, Secretary of the Navy; David F. Houston, Secretary of Agriculture; William B. Wilson, Secretary of Labor; William C. Redfield, Secretary of Commerce (at extreme right of picture); Franklin K. Lane, Secretary of Interior; Albert S. Burleson, Postmaster General; Newton D. Baker, Secretary of War, and Robert Lansing, Secretary of State.

CHAPTER IV.

THE CABINET

IN the Cabinet deliberations the President is both morally and legally supreme. While the Cabinet of the United States has no legal existence as such it has by custom become an integral part of the United States Government. The Constitution says that the President has the power to "require the opinion in writing of the principal officer in each of the Executive Departments upon any subject relating to the duties of their respective offices." Later on, it says, "The Congress may by law vest the appointment of such inferior officers as they deem proper in the President alone, in the courts of law or the heads of the Departments." That is all the Constitution says of what is generally called the Cabinet. However, the President's choice of the heads of the various Departments of the United States is rarely, if ever, questioned by the Senate, it being recognized that he has the right to call to his assistance men in whose judgment and wisdom he has confidence and with whom he can work and advise to the benefit of the country at large.

When the Cabinet meets, the President sits at the head of the table and the various cabinet members around it in the order of their seniority. It is generally supposed that questions are submitted to the Cabinet first for discussion and later that the Cabinet officers vote upon them. Such, of course, is not the case. The Cabinet acts in an advisory capacity only and has no power over the President in any way whatsoever. There is a story, probably apocryphal, of General Grant, who, when he and his Cabinet disagreed as to a certain policy, offered to put the matter to a vote. The President is reported to have called upon his Cabinet members in turn, beginning with the Secretary of State. As each Cabinet member's name was called, he is said to have answered "Aye." When the President had finished he called his own name and gravely responded "No." Then he said to the assembled Cabinet officers, "There are seven votes in the affirmative and one in the negative and," here President Grant paused, "the negative vote is in the majority." Whereupon the President did as he had intended to do all along in spite of the advice of his officers!

In the event of any serious disagreement between a Cabinet officer and the President there is only one course open and that is a resignation. Historic instances will occur to many. What is not so generally known, however, is that some Cabinet officers have to be asked to resign. Sometimes the asking is outright, as in a story told of Grant who made one of his Cabinet officers sit down at his own desk and dictated his resignation for him, and sometimes it is more gentle, as in the case of President McKinley and Secretary of War Alger. There was difference of opinion between President McKinley and his Secretary of War, and it is understood that it was not until a very vigorous hint had been given by those close

to the President that Mr. Alger saw the light and tendered his resignation. The case of Mr. Ballinger is fresh in the public mind and students of politics, at least, will not need to be reminded that this gentleman stayed in office for some time after there was a decided degree of friction between him and the Chief Magistrate of the land.

The President has a personal secretary, who in turn has many assistants. The job of being private secretary to the President of the United States is not, as one might think, that of an amanuensis. Rather has the office the dignity of a personal cabinet officer. The secretary to the President of the United States must be a man of great tact, ready memory, and have an able grasp upon political affairs. He is the one man about him whom the President must be in a position to trust absolutely, and the character of the many gentlemen who have held this office has been well shown by their future careers.

ORGANIZATION OF THE EXECUTIVE BRANCH OF THE UNITED STATES GOVERNMENT

Prepared by Mr. W. I. Swanton, Assistant Engineer U. S. R. S.

CHAPTER V.

THE DEPARTMENT OF STATE

THE following brief notes represent the abridgment of a ninety-two page pamphlet, prepared by the direction of the Secretary of State, which shows the enormous condensation necessary in a work of this kind.

The Department of State is of particular interest, in view of the fact that, after the Vice-President, the Secretary of State is the ranking official of the Government. In other words, should both the President and Vice-President die, the Secretary of State would become President. This really makes him the "Premier," although there is no official sanction for the title.

The act of July 27, 1789, created an executive department, to be known as the Department of Foreign Affairs. By the act of September 15, 1789, the name of the department was changed to that of the Department of State, the principal officer thereof to be called the

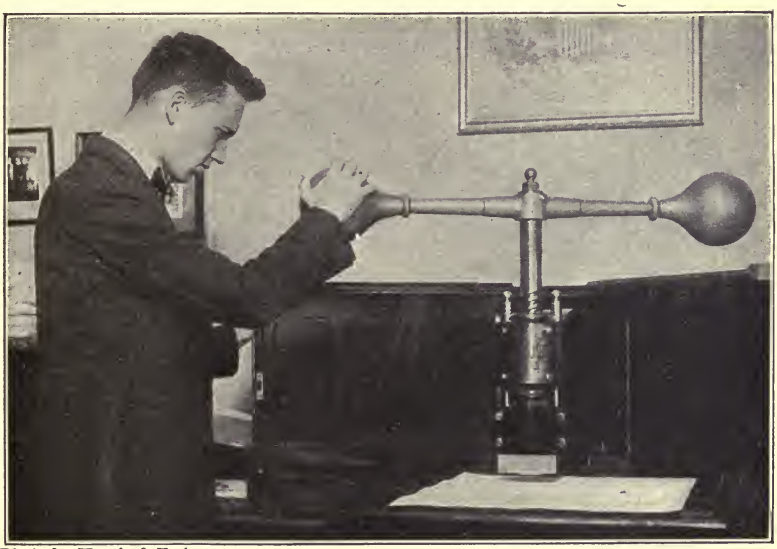


Photo by Harris & Ewing

THE GREAT SEAL OF THE UNITED STATES

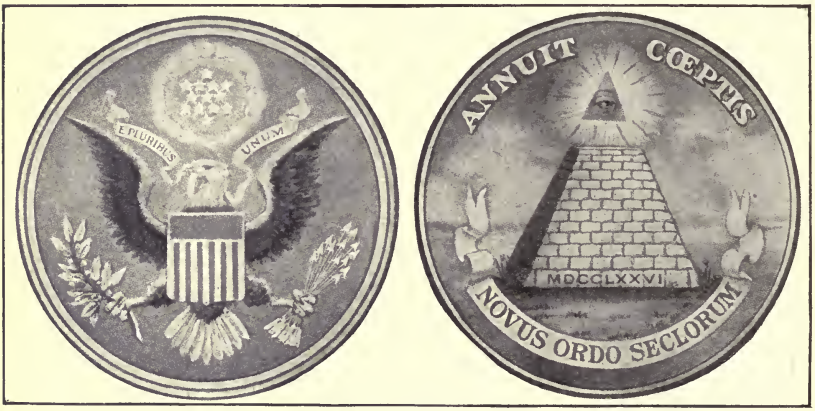
Separate written authority from the President must accompany his signed document before the Seal can be impressed

Secretary of State, and provision was made for the safe-keeping of the acts, records, and seal of the United States.

THE GREAT SEAL OF THE UNITED STATES OF AMERICA

The Department of State looks askance at any reproduction of the Great Seal and will never sanction its publication or use, but it will be found in cyclopedias, dictionaries and atlases. So its publication here needs no apology, although a request to make a cut of a passport was denied the writer largely because the Great Seal was shown on it. When properly understood the seal should have the same respect as the flag. A committee was appointed on July 4, 1776, to prepare a Great Seal. The members were Benjamin Franklin, John Adams and Thomas Jefferson. Several excellent designs were submitted, but Congress was not satisfied, so another committee was appointed composed of Messrs. Middleton, Boudinot and Rutledge, and finally, on June 20, 1782, the Great Seal, as we now know, was adopted. It must be admitted that the heraldry is a little mixed, as might be supposed of the sturdy Americans who were far removed from the Heralds' College. A heraldic interpretation is dry and uninteresting, but in brief the sense is about as follows: The American Eagle bears on his breast an escutcheon composed of thirteen bars, supporting top, or a "chief," which is supposed to represent Congress. This all symbolizes the union and strength of the States preserved through the aid of Congress. The olive branch in the "dexter" talon represents peace, while the "sinister" talon holds thirteen arrows. In his beak is a scroll with the motto, *"E Pluribus Unum"* (one unity composed of many parts). What is above is called the "crest," but it is not really a crest at all, because the stars could not be tangibly represented as in nature, and attached to the top of a helmet, or could reasonably be represented as resting on a shield.

The reverse, which has never been cut, consists of an unfinished pyramid. In the zenith is an eye in a triangle surrounded by a glory. On the base of the pyramid are the letters, *"MDCCLXXVI,"* and underneath the motto, *"NOVUS ORDO SECLORUM"* (a new series of ages), while above is the motto, *"ANNUIT COEPTIS"* (God has favored the Undertaking).



THE GREAT SEAL OF THE UNITED STATES

The origin of *"E PLURIBUS UNUM"* is shrouded in mystery and is variously ascribed to Virgil and others.

In the early days the Secretary of State was charged with a multitude of duties, for under him all patents were issued; but in 1849, the work of the Patent Office was turned over to the Department of the Interior. Copyrights were also under the direction of the Secretary of State, but in 1850 it was transferred to another department. The census en-

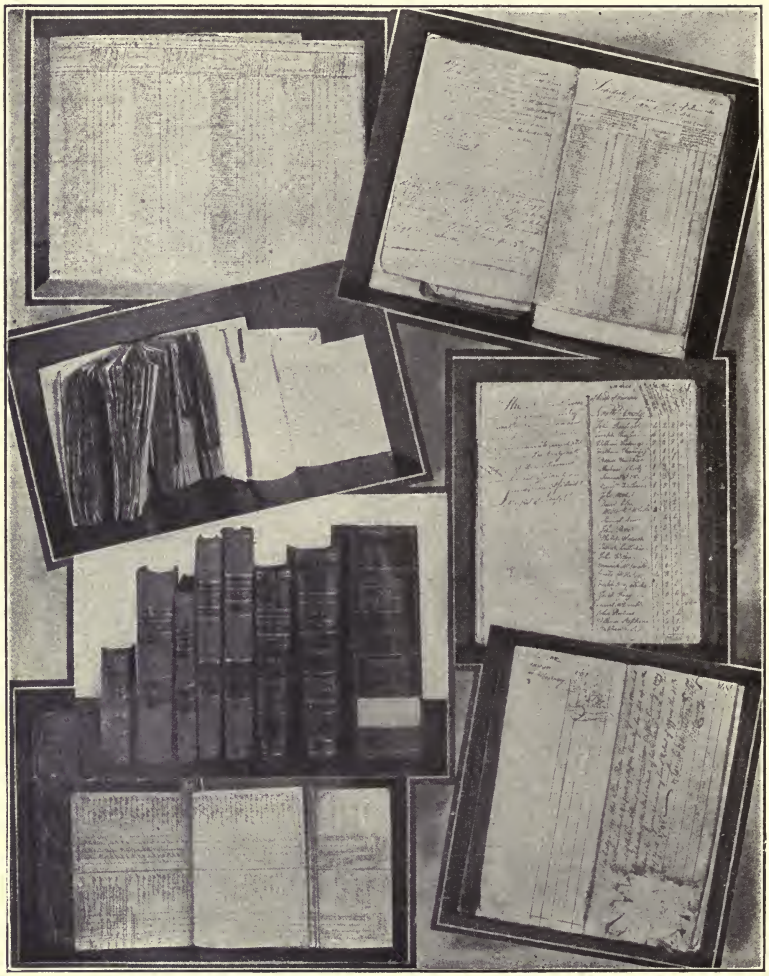
Consulate, Cairo, Egypt, with Native Guard

London (Eng.) American Consulate-General, August, 1914, Showing Crowds of Americans, Germans and Austrians Trying to Get into Office to Register, Obtain Passports, Relief, Etc.

Consulate at Mezreh, Palestine. Dung Briquettes in Foreground Being Dried for Fuel. Stone Rollers on Flat Earth Roof, to Roll After a Rain

American Consulate-General, Berlin, Disbursing British Relief Funds to British Subjects Not Interned, March, 1915

SOME TRIALS OF THE CONSULAR OFFICIAL



RECORDS OF THE FIRST CENSUS OF 1780 MADE BY THE DEPARTMENT OF STATE ARE STILL IN EXISTENCE

umeration was also under the charge of the Secretary of State in the early days. Certain matters relating to pardons were also under his jurisdiction, but in 1893 President Cleveland transferred such work to the Department of Justice. In 1856 a law was passed providing that the Secretary of State should be authorized to grant and issue passports, and to cause them to be granted and verified in foreign countries by diplomatic and consular officers, under such rules as the President might prescribe.

What might be called the organic

law, indicating the duties of the Secretary of State, is comprised in Section 202 of the Revised Statutes, reading as follows:

"The Secretary of State shall perform such duties as shall from time to time be enjoined on or intrusted to him by the President relative to correspondences, commissions, or instructions to or with public ministers or consuls from the United States, or to negotiations with public ministers from foreign States or princes, or to memorials or other applications from foreign public ministers or other foreigners, or to such other matters respecting foreign affairs as the President of the United States shall assign to the department, and he shall conduct the business of the department in such manner as the President shall direct: *Provided*, That the Secretary of State may prescribe duties for the Assistant Secretaries, the solicitor, not interfering with his duties as an officer of the Department of Justice, and the clerks of bureaus, as well as for all the other employees in the department, and may make changes and transfers therein when, in his judgment, it becomes necessary. (June 20, 1874, vol. 18, p. 90.)"

By the act of February 3, 1887, the Secretary of State was charged with the duty of certifying to the two Houses of Congress, and with the publication in some newspaper, of the Presidential election returns.

Among the other duties of the Secretary of State might be mentioned the communication and correspondence of the President with the governors of the States and the attestation of all presidential proclamations, together with the publication of the laws and the Statutes at Large in the United States, embracing all acts of Congress, all proclamations issued by the President, all treaties between the United States and foreign nations, including postal conventions, and all concurrent resolutions of the two Houses of Congress.

The compensation of the Secretary of State, under the act of September 11, 1789, was $3,500; under the act of February 20, 1819, it was raised to $6,000; in 1853, increased to $8,000; and under the act of March 4, 1911, increased to $12,000.

In 1909 the question of reorganization was taken up, and it was found necessary to modernize and otherwise make for efficiency. This was caused by a number of reasons. The foreign trade of the country had been growing at an enormous extent. The people, endeavoring to market their manufactured products abroad, found themselves engaged in competition with the highly developed industries of England, France, Germany, and other countries; they were brought face to face, not only with the questions of tariffs and customs administration, but also with the need of that measure of diplomatic and consular support enjoyed by their competitors.

The war with Spain had marked a new epoch in the history of American foreign relations. The American people, after having been regarded for many years as a stay-at-home nation, absorbed in the development of their own resources, had suddenly been recognized to have assumed a new position among nations, so that it would be thenceforth impossible for this Government to escape the responsibilities of being one of the great forces in international affairs, and of taking a more prominent part in discussions and deliberations concerning matters of international importance.

Consequently the Department of State had been called upon to deal with a multitude of questions with which, before the Spanish war, it had not been concerned. The Hague conferences, the adjustment of boundaries and other questions between the United States and Mexico and Canada, the arbitration of disputed questions with Canada and other nations, the negotiation of treaties to meet new conditions arising from the growth of the foreign interests of our people, the efforts of the United States to improve the conditions in Central America, the constantly increasing number of questions arising from the development of Mexico, and the adjustment of

difficulties and protection of the interests of nearly 40,000 of our citizens who had temporarily taken up their residence and invested nearly $1,000,000,000 of American money in that country, the reorganization and improvement of the Diplomatic and Consular Services, and the increasing demand of the public upon those organizations—all these things and others had thrown upon the Department of State a mass of correspondence and a great number of questions for determination or discussion entirely beyond its ability to treat efficiently with the then existing equipment.

Every immigrant coming to this country, and every American going to a foreign country, increases, in one way or another, the possibility of work for the Department of State. The inadequacy of the force of the Department became critical, and a tentative reorganization of the Department upon modern lines, with a view to a maximum degree of efficiency, was then effected.

The Secretary of State is peculiarly the adviser of the President, especially those points involving broad questions of general policy, and the Secretary of State is also responsible for the conduct of foreign relations, and, in addition to the time required for the study of important diplomatic questions, he receives the representatives of foreign governments for the discussion of diplomatic business and is in touch with matters affecting treaties with the Committee on Foreign Relations of the Senate. The Assistant Secretary, who receives a salary of $5,000 a year, does not specialize, but must be prepared to be in close touch with all the larger questions of foreign policy, and relieve the Secretary, as far as possible, of a portion of the general work. This is a very responsible position in the Department.

The Second Assistant Secretary is assigned to the detailed treatment by the departmental and diplomatic services of current diplomatic and political questions, except such special matters as may, from time to time, be assigned the Counselor. It is his duty to direct the activities of all the bureaus and divisions in respect to the diplomatic questions that are constantly arising all over the world, and to examine and approve the correspondence in respect to such matters prepared for the signature of the Secretary or the Acting Secretary. His salary is $4,500 a year.

The administrative direction of the Diplomatic Service, as distinguished from the treatment of subjects of international intercourse, is delegated to the Third Assistant Secretary of State. He is responsible for the maintenance, upkeep, and expenditures for that service. He also directs the treatment of all questions in relation to international congresses, conferences, commissions, expositions, and ceremonial matters, and has the supervision of the Division of Western European Affairs. He is charged with the approval or disapproval of expenditures of public moneys in the department and the foreign service. His salary is $4,500 a year.

The administration of the Consular Service and the direction of its activities in connection with the promotion and extension of our foreign commerce is delegated to the Director of the Consular Service, who has immediate control of expenditures for the maintenance of that organization. He is also charged with the study and treatment of such special subjects as may, from time to time, be assigned to him by the Secretary and the Assistant Secretary of State. He also receives $4,500 per annum.

The Chief Clerk has the direction of the internal business of the department, of the clerical force, the methods of transacting business, including the receipt and transmission of mail, the purchase of supplies, etc. His compensation is $3,000 a year.

Generally speaking, the questions of law, international or municipal, which may be involved in the determination of matters brought before the department, are referred to the Solicitor's office. The result is, that the scope of the work coming before the office is very broad, including questions of constitutional law, admiralty law, criminal law, the law of torts, contracts, etc., and, of course, all branches and fields of international law. The more important of the matters which actually come before the office for determination are as follows:

Diplomatic claims
International extraditions
Citizenship, naturalization, expatriation, passports, etc.
Extraterritoriality and the jurisdiction of ambassadors, ministers, or consular courts
Neutrality, belligerency, contraband, asylum, etc.
International arbitrations
Distribution of awards

There are also seven chiefs of bureaus as follows:

Accounts and disbursing clerk
Appointments
Citizenship
Consular
Diplomatic
Indexes and archives
Rolls and library

The affairs of the department are also handled by Chiefs of Divisions, for

Far Eastern affairs
Information
Latin-American affairs
Mexican affairs
Near Eastern affairs
Western European affairs

There are also translators, assistant solicitors, law clerks, private and confidential secretaries, as well as dispatch agents in New York, San Francisco, New Orleans and London.

In the Bureau of Rolls and Library are contained some of the most valuable documents concerning our history, including the Declaration of Independence, Continental Congress records, and historical manuscripts of all kinds.

OUR CONSULAR SERVICE

FOR many years it has been the custom for Americans to ridicule the American Consular Service, holding up to scorn the comic opera creation who held the center of the stage with his palm-leaf fan and slow drawl as the prototype of a consular officer. In the distant past there may have been an occasional officer who lived down to this popular conception, but it is so no longer.

The modern Consular Service had its inception in the days of Grover Cleveland, although it was Theodore Roosevelt who put it upon its present firm, non-political and non-partisan basis, with merit and merit only as the cause for advancement. Since then it has grown in efficiency and size until to-day it is unrivaled.

In the past good results from the Consular Service were infrequent because of the method of appointment of consular officers without regard to their particular fitness for the places to which they were sent, or as the former Secretary of State, Mr. Root, expressed it, "The placing of round pegs in square holes." Since 1896, when the first order providing for an examination before appointment went into effect, the Service has been strengthened and improved until those who knew it in the old days can no longer recognize it.

Men who pass an examination for a Consular position to-day have to know a variety of things and know them well. Examinations are both oral and written, the two counting equally. The oral examination determines the candidate's business ability, alertness, general contemporary information, and natural fit-

IN CONGRESS, JULY 4, 1776.

The unanimous Declaration of the thirteen united States of America,

When in the Course of human events, it becomes necessary for one people to dissolve the political bands which have connected them with another, and to assume among the powers of the earth, the separate and equal station to which the Laws of Nature and of Nature's God entitle them, a decent respect to the opinions of mankind requires that they should declare the causes which impel them to the separation. —— We hold these truths to be self-evident, that all men are created equal, that they are endowed by their Creator with certain unalienable Rights, that among these are Life, Liberty and the pursuit of Happiness. — That to secure these rights, Governments are instituted among Men, deriving their just powers from the consent of the governed, — That whenever any Form of Government becomes destructive of these ends, it is the Right of the People to alter or to abolish it, and to institute new Government, laying its foundation on such principles and organizing its powers in such form, as to them shall seem most likely to effect their Safety and Happiness. Prudence, indeed, will dictate that Governments long established should not be changed for light and transient causes; and accordingly all experience hath shewn, that mankind are more disposed to suffer, while evils are sufferable, than to right themselves by abolishing the forms to which they are accustomed. But when a long train of abuses and usurpations, pursuing invariably the same Object evinces a design to reduce them under absolute Despotism, it is their right, it is their duty, to throw off such Government, and to provide new Guards for their future security. — Such has been the patient sufferance of these Colonies; and such is now the necessity which constrains them to alter their former Systems of Government. The history of the present King of Great Britain is a history of repeated injuries and usurpations, all having in direct object the establishment of an absolute Tyranny over these States. To prove this, let Facts be submitted to a candid world. —— He has refused his Assent to Laws, the most wholesome and necessary for the public good. —— He has forbidden his Governors to pass Laws of immediate and pressing importance, unless suspended in their operation till his Assent should be obtained; and when so suspended, he has utterly neglected to attend to them. —— He has refused to pass other Laws for the accommodation of large districts of people, unless those people would relinquish the right of Representation in the Legislature, a right inestimable to them and formidable to tyrants only. —— He has called together legislative bodies at places unusual, uncomfortable, and distant from the depository of their public Records, for the sole purpose of fatiguing them into compliance with his measures. —— He has dissolved Representative Houses repeatedly, for opposing with manly firmness his invasions on the rights of the people. —— He has refused for a long time, after such dissolutions, to cause others to be elected; whereby the Legislative powers, incapable of Annihilation, have returned to the People at large for their exercise; the State remaining in the mean time exposed to all the dangers of invasion from without, and convulsions within. —— He has endeavoured to prevent the population of these States; for that purpose obstructing the Laws for Naturalization of Foreigners; refusing to pass others to encourage their migrations hither, and raising the conditions of new Appropriations of Lands. —— He has obstructed the Administration of Justice, by refusing his Assent to Laws for establishing Judiciary powers. —— He has made Judges dependent on his Will alone, for the tenure of their offices, and the amount and payment of their salaries. —— He has erected a multitude of New Offices, and sent hither swarms of Officers to harrass our people, and eat out their substance. —— He has kept among us, in times of peace, Standing Armies without the Consent of our legislatures. —— He has affected to render the Military independent of and superior to the Civil power. —— He has combined with others to subject us to a jurisdiction foreign to our constitution, and unacknowledged by our laws; giving his Assent to their Acts of pretended Legislation: — For Quartering large bodies of armed troops among us: — For protecting them, by a mock Trial, from punishment for any Murders which they should commit on the Inhabitants of these States: — For cutting off our Trade with all parts of the world: — For imposing Taxes on us without our Consent: — For depriving us in many cases, of the benefits of Trial by Jury: — For transporting us beyond Seas to be tried for pretended offences: — For abolishing the free System of English Laws in a neighbouring Province, establishing therein an Arbitrary government, and enlarging its Boundaries so as to render it at once an example and fit instrument for introducing the same absolute rule into these Colonies: — For taking away our Charters, abolishing our most valuable Laws, and altering fundamentally the Forms of our Governments: — For suspending our own Legislatures, and declaring themselves invested with power to legislate for us in all cases whatsoever. — He has abdicated Government here, by declaring us out of his Protection and waging War against us. —— He has plundered our seas, ravaged our Coasts, burnt our towns, and destroyed the lives of our people. —— He is at this time transporting large Armies of foreign Mercenaries to compleat the works of death, desolation and tyranny, already begun with circumstances of Cruelty & perfidy scarcely paralleled in the most barbarous ages, and totally unworthy the Head of a civilized nation. —— He has constrained our fellow Citizens taken Captive on the high Seas to bear Arms against their Country, to become the executioners of their friends and Brethren, or to fall themselves by their Hands. —— He has excited domestic insurrections amongst us, and has endeavoured to bring on the inhabitants of our frontiers, the merciless Indian Savages, whose known rule of warfare, is an undistinguished destruction of all ages, sexes and conditions. In every stage of these Oppressions We have Petitioned for Redress in the most humble terms: Our repeated Petitions have been answered only by repeated injury. A Prince, whose character is thus marked by every act which may define a Tyrant, is unfit to be the ruler of a free people. Nor have We been wanting in attentions to our Brittish brethren. We have warned them from time to time of attempts by their legislature to extend an unwarrantable jurisdiction over us. We have reminded them of the circumstances of our emigration and settlement here. We have appealed to their native justice and magnanimity, and we have conjured them by the ties of our common kindred to disavow these usurpations, which, would inevitably interrupt our connections and correspondence. They too have been deaf to the voice of justice and of consanguinity. We must, therefore, acquiesce in the necessity, which denounces our Separation, and hold them, as we hold the rest of mankind, Enemies in War, in Peace Friends. ——

We, therefore, the Representatives of the united States of America, in General Congress, Assembled, appealing to the Supreme Judge of the world for the rectitude of our intentions, do, in the Name, and by Authority of the good People of these Colonies, solemnly publish and declare, That these United Colonies are, and of Right ought to be Free and Independent States; that they are Absolved from all Allegiance to the British Crown, and that all political connection between them and the State of Great Britain, is and ought to be totally dissolved; and that as Free and Independent States, they have full Power to levy War, conclude Peace, contract Alliances, establish Commerce, and to do all other Acts and Things which Independent States may of right do. —— And for the support of this Declaration, with a firm reliance on the protection of divine Providence, we mutually pledge to each other our Lives, our Fortunes and our sacred Honor.

John Hancock

Button Gwinnett
Lyman Hall
Geo Walton

Wm Hooper
Joseph Hewes
John Penn

Edward Rutledge

Thos Heyward Junr.
Thomas Lynch Junr.
Arthur Middleton

Samuel Chase
Wm Paca
Thos Stone
Charles Carroll of Carrollton

George Wythe
Richard Henry Lee
Th Jefferson
Benja Harrison
Thos Nelson jr.
Francis Lightfoot Lee
Carter Braxton

Robt Morris
Benjamin Rush
Benja Franklin
John Morton
Geo Clymer
Jas Smith
Geo. Taylor
James Wilson
Geo. Ross
Caesar Rodney
Geo Read
Tho M:Kean

Wm Floyd
Phil. Livingston
Frans. Lewis
Lewis Morris
Richd Stockton
Jno Witherspoon
Fras. Hopkinson
John Hart
Abra Clark

Josiah Bartlett
Wm Whipple
Saml Adams
John Adams
Robt Treat Paine
Elbridge Gerry
Step. Hopkins
William Ellery
Roger Sherman
Sam.el Huntington
Wm Williams
Oliver Wolcott
Matthew Thornton

United States of America, Department of State. To all to whom these Presents shall come, Greeting:
I certify that the foregoing is a fac-simile of the original Declaration of Independence as it was engrossed, laid on the Speaker's table, and signed in the Continental Congress in 1776, and deposited with the papers of the Continental Congress in the Department of State.
In testimony whereof, I, John Hay, Secretary of State of the United States, have hereunto subscribed my name and caused the seal of the Department of State to be affixed.
Done at the City of Washington this [illegible] day of [illegible], A.D. [illegible], and of the Independence of the United States of America the one hundred and twenty-[illegible].

John Hay

SIGNERS OF THE DECLARATION OF INDEPENDENCE

No.*	Name	Colony	Occupation	Born	Birthplace	Died	Aged
6	Adams, John	Mass. Bay	Lawyer	Oct. 30, 1735	Braintree, Mass.	July 4, 1826	92
2	Adams, Samuel	Mass. Bay	Merchant	Sept. 22, 1722	Boston, Mass.	Oct. 3, 1803	81
9	Bartlett, Josiah	New Hampshire	Physician	Nov., 1729	Amesbury, Mass.	May 19, 1795	67
51	Braxton, Carter	Virginia	Planter	Sept. 10, 1736	Newington, Va.	Oct. 10, 1797	62
31	Carroll, Charles	Maryland	Lawyer	Sept. 20, 1737	Annapolis, Md.	Nov. 14, 1832	96
44	Chase, Samuel	Maryland	Lawyer	April 17, 1741	Somerset Co., Md.	June 19, 1811	71
14	Clark, Abraham	New Jersey	Lawyer	Feb. 15, 1726	Elizabethtown, N. J.	Sept., 1794	69
38	Clymer, George	Pennsylvania	Merchant	Jan. 24, 1739	Philadelphia, Pa.	Jan. 23, 1813	75
22	Ellery, William	Rhode Island	Lawyer	Dec. 22, 1727	Newport, R. I.	Feb. 15, 1820	93
5	Floyd, William	New York	Farmer	Dec. 17, 1734	Setauket, N. Y.	Aug. 1, 1821	87
27	Franklin, Benjamin	Pennsylvania	Printer	Jan. 17, 1706	Boston, Mass.	April 17, 1790	85
8	Gerry, Elbridge	Mass. Bay	Merchant	July 17, 1744	Marblehead, Mass.	Nov. 23, 1814	71
40	Gwinnett, Button	Georgia	Merchant	1732	England	May 27, 1777	45
1	Hancock, John	Mass. Bay	Merchant	Jan. 12, 1737	Braintree, Mass.	Oct. 8, 1793	57
47	Hall, Lyman	Georgia	Physician	1731	Conn.	1784	53
54	Harrison, Benj.	Virginia	Farmer	1740	Berkeley, Va.	April, 1791	51
13	Hart, John	New Jersey	Farmer	1715	Hopewell, N. J.	1780	65
35	Hewes, Joseph	North Carolina	Lawyer	1730	Kingston, N. J.	Nov. 10, 1779	49
56	Heyward, Jr., Thos.	South Carolina	Lawyer	1746	St. Luke's, S. C.	Mar. 1809	63
23	Hooper, Wm.	North Carolina	Lawyer	June 17, 1742	Boston, Mass.	Oct., 1790	49
12	Hopkins, Steph.	Rhode Island	Farmer	Mar. 7, 1707	Scituate, Mass.	July 13, 1785	79
29	Hopkinson, Francis	New Jersey	Lawyer	1737	Philadelphia, Pa.	May 9, 1791	54
11	Huntington, Saml.	Connecticut	Lawyer	July 3, 1732	Windham, Conn.	Jan. 5, 1796	64
32	Jefferson, Thos.	Virginia	Lawyer	April 13, 1743	Shadwell, Va.	July 4, 1826	83
48	Lee, Richard Henry	Virginia	Soldier	Jan. 20, 1732	Stratford, Va.	June 19, 1794	62
55	Lee, Francis Lightfoot	Virginia	Farmer	Oct. 14, 1734	Stratford, Va.	April, 1797	63
7	Lewis, Francis	New York	Merchant	Mar., 1713	Llandaff, Wales	Dec. 30, 1803	91
3	Livingston, Philip	New York	Merchant	Jan. 15, 1716	Albany, N. Y.	June 12, 1778	63
43	Lynch, Jr., Thos.	South Carolina	Lawyer	Aug. 5, 1749	Pr. George's Co., S. C.	1779	30
39	M'Kean, Thos.	Delaware	Lawyer	Mar. 19, 1734	New London, Pa.	June 24, 1817	84
50	Middleton, Arthur	South Carolina	Lawyer	1743	Middleton Pl., S. C.	Jan. 1, 1788	44
15	Morris, Lewis	New York	Farmer	1726	Morrisania, N. Y.	Jan. 22, 1798	72
24	Morris, Robert	Pennsylvania	Merchant	Jan. 20, 1734	Lancashire, England	May 8, 1806	73
16	Morton, John	Pennsylvania	Surveyor	1724	Ridley, Pa.	April, 1777	53
49	Nelson, Jr., Thos.	Virginia	Statesman	Dec. 26, 1738	York, Pa.	Jan. 4, 1789	51
28	Paca, William	Maryland	Lawyer	Oct. 31, 1740	Wye Hall, Md.	1799	59
4	Paine, Robert Treat	Mass. Bay	Lawyer	1731	Boston, Mass.	May 11, 1814	84
18	Penn, John	North Carolina	Lawyer	May 17, 1741	Caroline Co., Va.	Sept., 1788	48
41	Read, George	Delaware	Lawyer	1734	Cecil Co., Md.	1798	64
52	Rodney, Caesar	Delaware	General	1730	Dover, Del.	1783	53
37	Ross, George	Pennsylvania	Lawyer	1730	Newcastle, Del.	July, 1779	49
46	Rush, Benjamin	Pennsylvania	Physician	Dec. 24, 1745	Berberry, Pa.	April 19, 1813	68
34	Rutledge, Edward	South Carolina	Lawyer	Nov., 1749	Charleston, S. C.	Jan 23, 1800	51
19	Sherman, Roger	Connecticut	Shoemaker	April 19, 1721	Newton, Mass.	July 23, 1793	73
36	Smith, James	Pennsylvania	Lawyer	1710	Ireland	July 11, 1806	96
10	Stockton, Richard	New Jersey	Lawyer	Oct. 1, 1730	Princeton, N. J.	Feb. 28, 1781	51
30	Stone, Thomas	Maryland	Lawyer	1742	Pointoin Manor, Md.	Oct. 5, 1787	45
33	Taylor, Geo.	Pennsylvania	Physician	1716	Ireland	Feb. 23, 1781	65
17	Thornton, Matthew	New Hampshire	Physician	1714	Ireland	June 24, 1803	89
53	Walton, George	Georgia	Lawyer	1740	Frederick Co., Va.	Feb. 2, 1804	64
20	Whipple, William	New Hampshire	Sailor	1730	Kittery, Me.	Nov. 28, 1785	55
26	Williams, William	Connecticut	Statesman	April 8, 1731	Lebanon, Conn.	Aug. 2, 1811	81
42	Wilson, James	Pennsylvania	Lawyer	1742	St. Andrews, Scotland	Aug. 28, 1798	56
21	Witherspoon, John	New Jersey	Minister	Feb. 5, 1722	Yester, Scotland	Nov. 15, 1794	73
25	Wolcott, Oliver	Connecticut	Physician	Nov. 26, 1726	Windsor, Conn.	Dec. 1, 1797	72
45	Wythe, George	Virginia	Lawyer	1726	Elizabeth Co., Va.	June 8, 1806	80

* Order of signature

ness for the service, including moral, mental and physical qualifications, character, address and general education and good command of English. The written examination includes French, German or Spanish; the natural, industrial and commercial resources and the commerce of the United States, especially with reference to possibilities of increasing and extending the foreign trade of the United States; political economy and the elements of international, commercial and maritime law, American history, government and institutions; political and commercial geography; arithmetic (as used in commercial statistics, tariff calculations, exchange, accounts, etc.); the modern history, since 1850, of Europe, Latin-America and the Far East, with particular attention to political, commercial and economic tendencies.

After passing a stiff examination and getting an appointment, young consular officers go to school in Washington, at a "model consulate" in the Consular Bureau at the State Department. Every newly appointed consul is required to proceed to Washington and spend at least thirty days in this school learning just what he will be expected to do when he reaches his post, and how he may get the best results from whatever conditions confront him. Although this special form of training has been in force but a comparatively short time it is showing its good effect by the improvement in the work and reports of the consular officers, and by the attitude of appreciation and understanding of their duties which the consuls display as a result of the instructions.

A consular officer has no duty of greater importance than that of service to his countrymen. The splendid service rendered by United States consular officers in the field of the great war now raging is well known, and none of the unfortunates who were helped in Berlin, London, Paris and Belgium by our Consuls General, consuls and consular agents will ever forget the service they received. Some of the accompanying pictures show how great was the pressure on the consulates of the great neutral nation in the countries at war, where citizens of the enemy clamored for help, relief, passports, and the hundred and one things that only a trained, hard working and disinterested staff could do.

Important as such services are, they are, luckily, not often required. Nor is the gathering and transmittal of commercial information, important though that duty is, the whole work of a consular officer. Only when reading a list of his duties is it easy to comprehend why those who fill such positions must be highly educated and alert men.

For instance, a consular officer must maintain and promote all interests of American citizens. He is required to protect them in all privileges provided by treaty or conceded by usage; to *visé* and, when so authorized, to issue passports; when permitted by treaty, law or usage, to take charge of and settle the personal estates of Americans who may die abroad, without legal or other representatives, and remit the proceeds to the Treasury in case they are not called for by a legal representative within one year; to ship, discharge, and, under certain conditions, maintain and send American seamen to the United States; to settle disputes between masters and seamen of American vessels; to investigate charges of mutiny or insubordination on the high seas and send mutineers to the United States for trial; to render assistance in the case of wrecked or stranded American vessels, and, in the absence of the master or other qualified person, take charge of the wrecks and cargoes, if permitted to do so by the laws of the country; to receive the papers of American vessels arriving at foreign ports and deliver them after the discharge of the obligations of the vessels toward the members of their crews, and upon the production of clearances from the

AMERICANS IN FRONT OF EMBASSY AT BERLIN, WAITING THEIR TURN TO OBTAIN PASSPORTS AT OUTBREAK OF THE WAR

proper foreign port officials; to certify to the correctness of the valuation of merchandise exported to the United States where the shipment amounts to more than $100; to act as official witnesses to marriages of American citizens abroad; to aid in the enforcement of the immigration laws, and to certify to the correctness of the certificates issued by Chinese and other officials to Chinese persons coming to the United States; to protect the health of our seaports by reporting weekly the sanitary and health conditions of the port at which he resides, and by issuing to vessels clearing for the United States bills of health describing the condition of the ports, the vessels, crews, passengers and cargoes; and to take depositions and perform other acts which public notaries in the United States are authorized or required to perform.

In addition to the foregoing duties, consular officers in China, Turkey, Siam, Muskat, Morocco, and a few other so-called non-Christian countries, are invested with judicial powers over American citizens in those countries. These powers are usually defined by treaty, but generally include the trial of civil cases to which Americans are parties, and in some instances extend to the trial of criminal cases.

The service now employs about 1,700 people. The principal officers and their compensations are as follows:

Consuls General

Consul General of Class 1	$12,000
Consul General of Class 2	8,000
Consul General of Class 3	6,000
Consul General of Class 4	5,500
Consul General of Class 5	4,500

Consuls

Consul of Class 1	$8,000
Consul of Class 2	6,000
Consul of Class 3	5,000
Consul of Class 4	4,500
Consul of Class 5	4,000
Consul of Class 6	3,500
Consul of Class 7	3,000
Consul of Class 8	2,500
Consul of Class 9	2,000

At present there are 241 consuls in the nine classes.

The consular officer in London, Paris or Berlin lives a busy, active and civilized life. The consular officer in some small place in a semi-civilized country may have little to do and no amusement. But in either event he is a willing servant of his country and doing for it a work beyond computation in price, although it is a fact that fees collected for the multitudinous services he renders almost equal the cost of the service.

All fees received by any officer in the consular service for services rendered in connection with the duties of his office or as a consular officer, including fees for notarial services, and fees for taking depositions, executing commissions or letters rogatory, settling estates, receiving or paying out moneys, caring for or disposing of property, are paid into the Treasury of the United States. The only compensation of officers is their salaries, except in the case of consular agents. Consular agents are paid one half of the fees received in their offices, up to a maximum sum of one thousand dollars in any one year, the other half being paid into the Treasury.

The fees collected do not nearly equal the expenditures of the service. Fees for a deposition may run to $100, depending on its length.

The illustrations on page 481 show two types of consulates in far countries—the handsome residence at Cairo, Egypt, contrasted with the mud-roof dwelling in far off Turkey. But the type of dwelling makes little difference to its occupant—he is there to serve, to open the markets of his country to American manufacturers, and to serve Americans in need or in distress. Indeed, he does more than serve his own countrymen—not infrequently he serves the merchants of the country to which he is sent.

The Consular Reports — public documents published from the letters sent in to the Consular Bureau of the State Department—contain vital information regarding trade

conditions in all countries. How valuable these are was well brought out recently in a published interview with the president of the Sheffield (England) Chamber of Commerce. It seems that certain Sheffield manufacturers had sudden need to know the sources and distribution throughout the world of wolfram ore, from which tungsten, essential in the manufacture of high-resistance steel for guns and armor, is made. The president of the Chamber of Commerce was unable to locate the information he desired from British sources. In his interview he said:

"It was suggested that I would find it in the reports of American consuls. I did find it there. I discovered where wolfram was produced; the quality, state of the trade and amount available. That information assisted materially in bringing about the manufacture of tungsten powder in this country, which, although started during the war, has been a magnificent success and will be a great success after the war."

The Director of the Consular Service, Mr. Wilbur J. Carr, who has risen from the ranks in his twenty years of service, called attention recently to a unique feature of America's system, which is one reason why it is so efficient. This is the system of inspection. Speaking of it, Mr. Carr said:

"In this field we have been pioneers. The law of 1906 created five so-called consul generals at large. Each travels over a grand division of the world, inspecting each consular office once every two years. The Department of State is enabled by this means not only to detect and rectify irregularities in the work of individual consuls, but to enforce uniformity of method and organization. If a consular officer in a far-off corner of the globe, by inspiration or careful thought evolves an improved method of performing some routine duty or discovers a new and effective way by which the foreign trade of the United States may be promoted, this is discovered by the inspector on his next visit and if found good in every way, communicated to the Department of State, and by it to the other consuls at large, with the result that all which is best in individual offices and in the practices of individual officers becomes eventually the common property of the service. Other governments recognize the practical value of this inspection system. Great Britain has undertaken something analogous in a tentative way and the French foreign office has a like project under consideration."

OFFICIAL DUTIES

SECRETARY OF STATE

The Secretary of State is charged, under the direction of the President, with the duties appertaining to correspondence with the public ministers and the consuls of the United States, and with the representatives of foreign powers accredited to the United States; and to negotiations of whatever character relating to the foreign affairs of the United States. He is also the medium of correspondence between the President and the chief executives of the several States of the United States; he has the custody of the Great Seal of the United States, and countersigns and affixes such seal to all Executive proclamations, to various commissions, and to warrants for the extradition of fugitives from justice. He is regarded as the first in rank among the members of the Cabinet. He is also the custodian of the treaties made with foreign states, and of the laws of the United States. He grants and issues passports, and exequaturs to foreign consuls in the United States are issued through his office. He publishes the laws and resolutions of Congress, amendments to the Constitution, and proclamations declaring the admission of new States into the Union.

COUNSELOR

The Counselor becomes the Acting Secretary of State in the absence of the Secretary. He is charged with the supervision of such matters and the preparation of such correspondence as may be assigned to him by the Secretary.

ASSISTANT SECRETARIES OF STATE

Under the organization of the department the Assistant Secretary, Second Assistant Secretary and Third Assistant Secretary are charged with the supervision of all correspondence with the diplomatic and consular officers, and are intrusted with the preparation of the correspondence upon any questions arising in the course of the public business that may be assigned to them by the Secretary.

DIRECTOR OF THE CONSULAR SERVICE

The Director of the Consular Service is charged with the general supervision of the Consular Service and such other

duties as may be assigned to him from time to time by the Secretary.

CHIEF CLERK

The Chief Clerk has general supervision of the clerks and employees and of departmental matters; charge of the property of the department.

FOREIGN TRADE ADVISER

General supervision of foreign trade matters; diplomatic and consular correspondence and miscellaneous correspondence relating thereto.

DIPLOMATIC BUREAU

Diplomatic correspondence and miscellaneous correspondence relating thereto.

DIVISION OF LATIN-AMERICAN AFFAIRS

Diplomatic and consular correspondence, on matters other than those of an administrative character, in relation to Central America, Panama, South America and the West Indies.

DIVISION OF MEXICAN AFFAIRS

Diplomatic and consular correspondence, on matters other than those of an administrative character, in relation to Mexico.

DIVISION OF FAR EASTERN AFFAIRS

Diplomatic and consular correspondence, on matters other than those of an administrative character, in relation to Japan, China, and leased territories, Siberia, Hong-kong, French Indo-China, Siam, Straits Settlements, Borneo, East Indies, India, and in general the Far East.

DIVISION OF NEAR EASTERN AFFAIRS

Diplomatic and consular correspondence, on matters other than those of an administrative character, in relation to Germany, Austria-Hungary, Russia, Roumania, Servia, Bulgaria, Montenegro, Turkey, Greece, Italy, Abyssinia, Persia, Egypt, and colonies belonging to countries of this series.

DIVISION OF WESTERN EUROPEAN AFFAIRS

Diplomatic and consular correspondence, on matters other than those of an administrative character, in relation to Great Britain (Canada, Australia, New Zealand, and British colonies not elsewhere enumerated), Portugal, Spain, France, Morocco, Belgium, the Kongo, Switzerland, Norway, Sweden, the Netherlands, Luxemburg, Denmark and Liberia.

CONSULAR BUREAU

Consular correspondence and miscellaneous correspondence relating thereto. and administrative matters relating to the consular service.

BUREAU OF APPOINTMENTS

Custody of the Great Seal and applications for office, and the preparation of commissions, exequaturs, warrants of extradition, Departmental Register, diplomatic and consular lists and consular bonds; correspondence and other matters regarding entrance examinations for the foreign service.

BUREAU OF CITIZENSHIP

Examination of applications for passports, issuance of passports and authentications; receiving and filing duplicates of evidence, registration, etc., under act of March 2, 1907, in reference to expatriation of citizens and their protection abroad; keeping of necessary records thereunder; conduct of correspondence in relation to the foregoing.

BUREAU OF INDEXES AND ARCHIVES

Recording and indexing the general correspondence of the department; charge of the archives.

BUREAU OF ACCOUNTS

Custody and disbursement of appropriations and indemnity funds, and correspondence relating thereto.

BUREAU OF ROLLS AND LIBRARY

Custody of the rolls, treaties, etc.; promulgation of the laws, treaties, Executive orders and proclamations; care and superintendence of the library and public documents; care of papers relating to international commissions.

DIVISION OF INFORMATION

The preparation and distribution to the foreign service of diplomatic, commercial and other correspondence and documents important to their information upon foreign relations; editing "Foreign Relations" of the United States.

OFFICE OF THE LAW CLERK

Editing and indexing the laws, resolutions, public treaties and proclamations for publication in the Statutes at Large.

SUPERINTENDENT OF BUILDING

The superintendent of the State, War and Navy Department Building is the executive officer of the commission created by Congress, consisting of the Secretaries of State, War and Navy, for the government of this building. He has charge of, care, preservation, repairing, warming, ventilating, lighting and cleaning of the building, grounds and approaches, and disburses the special appropriations for this purpose; he has charge of all the employees of the building proper, and appoints them by direction of the Secretaries.

CHAPTER VI.

DEPARTMENT OF THE TREASURY

SECRETARY OF THE TREASURY

THE Secretary of the Treasury is charged by law with the management of the national finances. He prepares plans for the improvement of the revenue and for the support of the public credit; superintends the collection of the revenue, and directs the forms of keeping and rendering public accounts and of making returns; grants warrants for all moneys drawn from the Treasury in pursuance of appropriations made by law, and for the payment of moneys into the Treasury; and annually submits to Congress estimates of the probable revenues and disbursements of the Government. He controls the construction and main-

THE TREASURY BUILDING, WASHINGTON, D. C.

tenance of public buildings, the coinage and printing of money, the administration of the Coast Guard and the Public Health branches of the public service. He is *ex-officio* chairman of the Federal Reserve Board created by act approved December 23, 1913, known as the "Federal Reserve Act."

There are three Assistant Secretaries in charge of the bureaus and divisions of the Treasury Department. One has charge of Public Health Service, Supervising Architect's Office, the selection of sites for public buildings, Coast Guard, Appointment Division, General Supply Committee, Section of Surety Bonds and all unassigned business of the Department.

To the Assistant Secretary in charge of fiscal bureaus is assigned general supervision of all matters relating to the Office of the Comptroller of the Currency, the Office of the Treasurer of the United States, the Bureau of Internal Revenue, the Bureau of the Mint, the Office of the Comptroller of the Treasury, the Auditors of the several departments, the Register of the Treasury, the Bureau of Engraving and Printing, the Division of Bookkeeping and Warrants, the Division of Loans and Currency, the Division of Mail and Files, the Division of Printing and Stationery, the Division of Public Moneys, the Secret-Service Division, the Federal Farm Loan Board, and the Office of the Disbursing Clerk.

To the Assistant Secretary in charge of customs is assigned the general supervision of the Division of Customs, of all matters pertaining to the Customs Service, and the Bureau of War-Risk Insurance, as referred to later on.

CHIEF CLERK

The chief clerk is the chief executive officer of the Secretary, and, under the direction of the Secretary and Assistant Secretaries, is charged with the enforcement of departmental regulations general in their nature; is by law superintendent of the Treasury Building and other related buildings and rolling stock belonging to the department; the direction of engineers, watchmen, firemen, etc., connected with the maintenance and protection of the Treasury buildings, etc.; the expenditure of appropriations for contingent expenses; the administrative control of appropriations made for Government exhibits at various expositions; the supervision and general administration of the General Supply Committee; handles offers in compromise cases; the custody of the records, files and library of the Secretary's office; the custody of all sites for proposed buildings in Washington; the checking of all mail relating to the personnel of the Treasury Department; the handling of requests for certified copies of official papers, and the charge of all business of the Secretary's office which is not otherwise assigned.

COMPTROLLER OF THE CURRENCY

The Comptroller of the Currency is the chief officer of that bureau of the Treasury Department which is charged with the execution of all laws passed by Congress relating to the issue and regulation of the national currency, generally known as national bank notes, secured by United States bonds; and under the supervision of the Federal Reserve Board is also in charge of the issue of circulating notes to Federal Reserve banks.

In addition to these powers the Comptroller exercises general supervision over all national banks throughout the United States, including Alaska and Hawaii, in the matter of their organization and regulation. He is vested with the power to appoint receivers and to enforce penalties prescribed for

SEPARATING CHARRED BANK BILLS

violations of the national bank act. Under the Federal Reserve act he executed and issued the certificates or charters for the Federal Reserve banks. The Comptroller of the Currency is *ex officio* a member of the Federal Reserve Board.

Reports of condition of all national banks are made to the Comptroller not less frequently than five times a year, by the banks, and also periodically by the national bank examiners appointed by him.

His powers are exercised under the general supervision of the Secretary of the Treasury, but under the law his annual report is made direct to Congress; all other bureaus of the Treasury Department report to Congress through the Secretary of the Treasury, and these reports are printed.

TREASURER OF THE UNITED STATES

The Treasurer of the United States receives and keeps the moneys of the United States and disburses the same upon warrants drawn by the Secretary of the Treasury, countersigned by the Comptroller of the Treasury, and not otherwise. He takes receipts for all moneys paid by him and gives receipts for all moneys received, and all receipts for moneys received by him shall be endorsed upon warrants signed by the Secretary of the Treasury, without which warrant so signed, no acknowledgment for money received into the public Treasury shall be valid. He renders his accounts to the Comptroller of the Treasury quarterly, or oftener if required, and transmits copies thereof, when settled, to the Secretary of the Treasury. The moneys in his hands are at all times subject to the inspection of the Secretary of the Treasury and the Comptroller of the Treasury. The Treasurer makes a report to the Secretary of the Treasury every 30th of June, showing the condition of all of the several accounts.

COMMISSIONER OF INTERNAL REVENUE

The Commissioner of Internal Revenue has general superintendence of the collection of all internal-revenue taxes, the enforcement of internal-revenue laws, appointment of internal-revenue employees, compensation and duties of gaugers, storekeepers and other subordinate officers; the preparation and distribution of stamps, instructions, regulations, forms, blanks, hydrometers, stationery, etc.

TESTING ALCOHOLIC LIQUORS

DIRECTOR OF THE MINT*

Five coinage mints have been established in different sections of the country, of which two, located at New Orleans, La., and Carson City, Nev., now operate only as Assay Offices. The Mints now engaged in coinage operations are located at Philadelphia, San Francisco and Denver, that at Philadelphia being the largest. In addition to the Assay Offices located at New Orleans, La., and Carson City, Nev., the Government maintains six others, located at New York City, Seattle, Wash.; Deadwood, S. D.; Boise, Idaho; Salt Lake City, Utah, and Helena, Montana.

The headquarters of the Mint Service are in the Treasury Department, Washington, D. C., known as the Bureau of the Mint. This consists of the office of the Director of the

*The subject of the assay of coins, bullion, etc., and the minting of money forms an interesting chapter in the first part of this book. (Pages 309 to 320.)

Mint, an assay laboratory for the purpose of testing the weight and fineness of the coins made at the several mints, and a clerical force which, under the Director of the Mint, reviews the accounts of the various institutions, prepares for publication, quarterly, an estimate of the value of the standard coins of foreign countries for custom house and other public purposes, and works up the statistical data for the annual report of the Director on the operations of the Mint Service for the fiscal year, including also statistics of the production of precious metals in the United States and the world for the calendar year.

MONEY OF ALL KINDS IS TRANSPORTED IN HEAVILY GUARDED TRUCKS

The Mints and Assay Offices have been established in localities suitable for the convenient acquisition of gold and silver by the Government for the purpose of coinage. Gold and silver bullion is received and paid for at its exact valuation (the price of gold remaining stationary, while that of silver fluctuates) and the Assay Offices forward their receipts of the precious metals to the Mints to be coined. Much of the metal is not suitable for immediate coinage, and refineries are maintained at the Mints at San Francisco and Denver and the Assay Office at New York City to purify the metal. Such of it as may be needed for coinage is then alloyed with copper, the proportions being nine parts of gold or silver to one part of copper, making what is known as 900 fine or "standard" metal, which has been found most suitable for coins, the pure gold or silver being comparatively soft, and subject to appreciable abrasion or wear. Minor coins are manufactured from nickel and bronze, the stocks of the necessary metals being bought in the open market as required.

As the stock of gold in the country has accumulated far beyond the needs for that metal as a circulating medium, it has been found most convenient and economical, after filling the yearly demands for new gold coin, to melt the balance of this

precious metal into bars of uniform and convenient size, to be stored in the vaults of the mints and held as a reserve against which gold certificates may be issued.

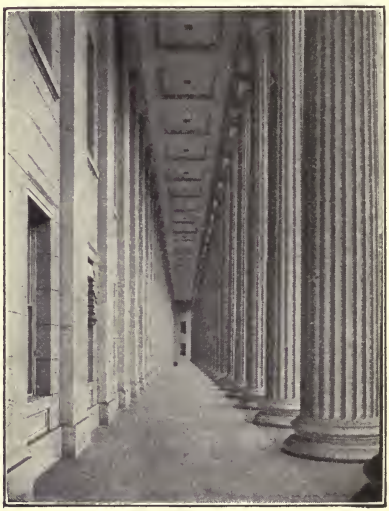
New coin usually gets into circulation through the Disbursing Office of the Treasury Department and banking institutions in exchange for the larger denominations of money.

The mints manufacture not only all of the domestic coin, but also the coinage for the Philippine Islands and, as their business permits, such of the coinage of adjacent countries as it is found expedient and practicable to handle.

At the Philadelphia Mint there is maintained a complete engraving and medal-making establishment, where are manufactured all dies used in the domestic and Philippine coinage, and also dies and medals of a national character.

COMPTROLLER OF THE TREASURY

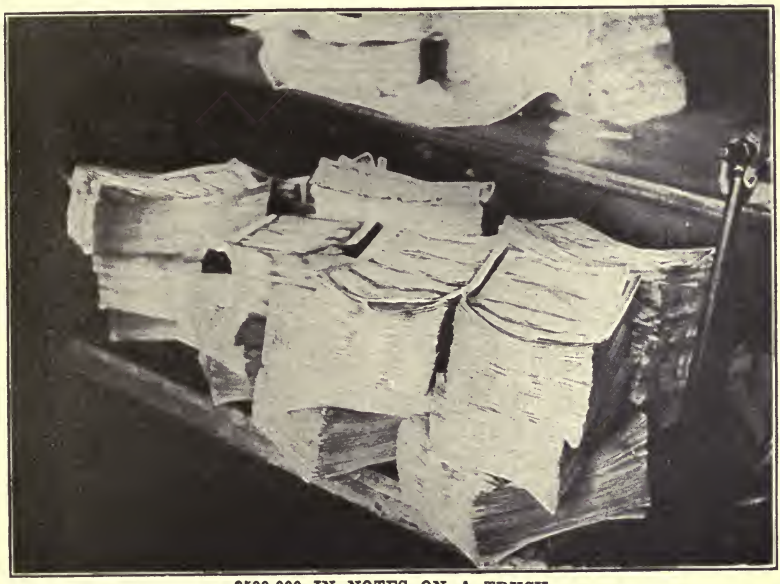
The Comptroller of the Treasury, under the direction of the Secretary of the Treasury, prescribes the forms of keeping and rendering all public accounts except those relating to postal revenues and the expenditures therefrom. He is charged with the duty of revising accounts upon appeal from settlements made by the auditors. Upon the application of disbursing officers, the head of any executive department, or other independent establishment not under any of the executive departments, the Comptroller is required to render his advance decision upon any question involving a payment to be made by them or under them, which decision, when rendered, governs the auditor and the Comptroller in the settlement of the account involving the payment inquired about. He is required to approve, disapprove, or modify all decisions by auditors making an original construction or modifying an existing construction of statutes, and certify his action to the auditor whose duties are affected thereby. Under his direction the several auditors superintend the recovery of all debts finally certified by them, respectively, to be due the United States, except those arising under the Post Office Department. He superintends the preservation by the auditors of all accounts which have been finally adjusted by them, together with the vouchers and certificates relating to the same. He is required, on his own motion, when in the interests of the Government, to revise any account settled by any auditor. In any case where, in his opinion, the interests of the Government require, he may direct any of the auditors forthwith to audit and settle any particular account pending before the said auditor for settlement. It is his duty to countersign all warrants authorized by law to be signed by the Secretary of the Treasury.



PORTICO OF THE TREASURY

REGISTER OF THE TREASURY

The Register of the Treasury signs all bonds of the United States, the bonds of the District of Columbia, the Philippine Islands, the city of Manila, the city of Cebu, and the Porto Rican gold loans, and keeps records showing the daily outstanding balances thereof. He certifies to the Treasurer of the United States, the Auditor for the Treasury, and the Loans and Currency Division, Secretary's Office, the interest due on United States loans at interest periods; also gives an administrative examination to paid interest checks received from the Treasurer, and transmits the same to the Auditor for the Treasury. He examines and records all paid interest coupons and all other United States securities redeemed, and keeps records of the outstanding principal and interest of the bonded indebtedness of the Government.



$500,000 IN NOTES ON A TRUCK

BUREAU OF ENGRAVING AND PRINTING*

The Bureau of Engraving and Printing designs, engraves, prints and finishes all of the securities and other similar work of the Government, embracing United States notes, bonds, and certificates, National Bank notes, Federal Reserve notes, internal-revenue, postage and customs stamps, Treasury drafts and checks, disbursing officers' checks, licenses, commissions, patent and pension certificates, and portraits authorized by law of deceased Members of Congress and other public officers; also all postage stamps and all securities issued by the Bureau of Insular Affairs to our insular possessions.

*A special chapter by Director Ralph will be found in the first part of this book and is filled with interesting facts and pictures. (See pages 299 to 307.)

THE UNITED STATES PUBLIC HEALTH SERVICE

By RUPERT BLUE, Surgeon-General

THE United States Public Health Service was created as the United States Marine Hospital Service by the act approved July 16, 1798. It continued as the United States Marine Hospital Service until July 1, 1902, when Congress changed the name to that of the Public Health and Marine Hospital Service of the United States. The act approved August 14, 1912, further changed the name of the Service to that of the Public Health Service, and greatly increased its powers and functions. As originally created the United States Marine Hospital Service had for its function the medical and surgical relief of the sick and injured seamen of the merchant marine and the Navy. The organic act placed the Marine Hospital Service in the Treasury Department, where it has continued to remain as a bureau. The organic act was amended by the acts of March 2, 1799, May 5, 1802, February 26, 1811, and July 29, 1870. As at present organized the Bureau of the Public Health Service is situated at Washington, D. C., and comprises seven divisions, the operations of which are co-ordinated and each under the immediate supervision of the Surgeon General. An Assistant Surgeon General is in charge of each of these divisions, excepting the miscellaneous division.

Through the Division of Marine Hospitals and Relief professional care is taken of sick and disabled seamen at twenty-two marine hospitals and one hundred and twenty-three other relief stations. The beneficiaries include officers and crews of registered, enrolled, or licensed vessels of the United States and of the Coast Guard and Lighthouse Service; seamen employed on vessels of the Mississippi River Commission, and of the Engineer Corps of the Army; keepers and surfmen of the Coast Guard. A purveying depot for the purchase and issuance of supplies is maintained at Washington. Physical examinations of officers and seamen and keepers and surfmen of the Coast Guard and the examinations for the detection of color-blindness in masters, mates, and pilots are conducted through this division, and the medical evidence of disability in claims for benefits against the Coast Guard are reviewed.

Through the Division of Domestic (Interstate) Quarantine is enforced Section 3 of the act of February 15, 1893, relating to the prevention of the spread of contagious or infectious diseases from one State or Territory into another. The control of the interstate spread of disease is effected by the Interstate Quarantine Regulations, compiled by this division. These regulations prohibit the carrying of persons afflicted with contagious diseases by interstate carriers and provide the conditions under which certain other infected persons may be transported. They provide that the vehicles of these carriers be maintained in a sanitary condition and that water furnished thereon shall conform to the bacteriological standard for drinking water supplied to the public by common carriers in interstate traffic as adopted by the Treasury Department on October 21, 1914. For the enforcement and administration of these regulations the country has been divided into twelve Interstate Sanitary Districts, each under the direction of this division. Laboratories have been established at central cities in these districts and an officer of the Public Health Service placed in each. The education of the general public in hygiene

and sanitation is conducted by the Domestic Quarantine Division by means of lectures, the loan of stereopticon slides to physicians, welfare workers, educators, etc., by exhibits, such as at the Panama Pacific International Exposition and on the Government Safety First Train, and by press items issued to about 8,000 newspapers. Sanitary and relief work in Alaska, hospitals and sanitary work at international exposing thereto. He has control of fifty-five Federal quarantine stations in the United States, and others in the Philippines, Hawaii, and Porto Rico, and supervises the medical officers detailed in the offices of the American consular officers at foreign ports to prevent the introduction of contagious or infectious diseases into the United States. Under section 17 of the act approved February 20, 1907, he has supervision over the

EXAMINING AN ALIEN AT ELLIS ISLAND BY MENTAL TESTS

tions, inspection of Government buildings for sanitary defects, and the important duty of the suppression of epidemics come within the scope of this division.

Through the Division of Foreign and Insular Quarantine and Immigration the Surgeon General enforces the national quarantine laws and prepares the regulations relat- medical officers engaged in the physical and mental examinations of all arriving aliens.

In the Division of Personnel and Accounts are kept the records of the officers and of the expenditures of the appropriations.

The Division of Sanitary Reports and Statistics collects and publishes information regarding the prevalence

and geographic distribution of diseases dangerous to the public health in the United States and foreign countries. Court decisions, laws, regulations, and ordinances pertaining to the public health are compiled, digested and published. Its publications contain articles on subjects relating to the public health. This division issues the Public Health Reports (weekly) and Supplements to, and Reprints from, the Public Health Reports.

The Division of Scientific Research conducts the scientific investigations of the service. Intensive studies of diseases of man, including hookworm diseases, malaria, pellagra, trachoma, typhoid fever, and tuberculosis, of school, mental, and industrial hygiene, of rural sanitation, of public health administration, of water supplies and sewage, and of coastal waters are carried on from special headquarters in the field in co-operation with State and local health authorities. Technical and purely laboratory studies are conducted at the Hygienic Laboratory in Washington, at special field laboratories, and at the leprosy investigation station in Hawaii. Information thus obtained is disseminated through publications, correspondence, lectures, and conferences with health authorities concerning the results of field studies in their jurisdictions. Through the division the department enforces the act of July 1, 1902, "to regulate the sale of viruses, serums, etc." The Surgeon General is required by law to call an annual conference of State and territorial health authorities, and special conferences may also be called at any time. For advice in respect to scientific investigations he may convene the advisory board of the Hygienic Laboratory.

Through the Miscellaneous Division the various service publications are issued, including the annual reports, public health reports, supplements, and reprints, public health bulletins of the Hygiene Laboratory, and miscellaneous publications on health topics.

The commissioned corps of the United States Public Health Service on July 1, 1916, consisted of the Surgeon General, 6 Assistant Surgeon Generals, 1 Assistant Surgeon General at large, 13 senior surgeons, 72 surgeons, 37 passed assistant surgeons, and 70 assistant surgeons. In addition there are scientific assistants, consisting of acting assistant surgeons, epidemiologists, internes at marine hospitals, pharmacists, etc.

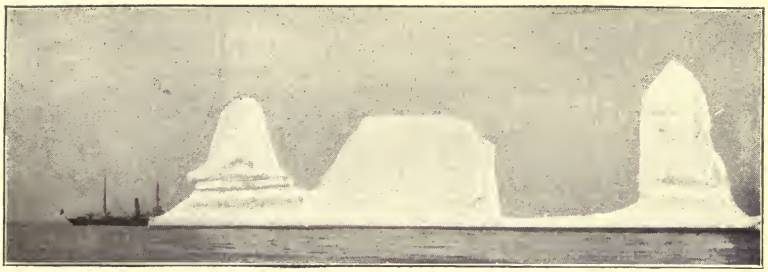
UNITED STATES COAST GUARD*

By Captain Commandant E. P. Bertholf

The Captain Commandant of the Coast Guard is charged by law with the administration of the Coast Guard, under the direction of the Secretary of the Treasury. Headquarters are located at the Treasury Department. The act of January 28, 1915, provided that the Coast Guard be created in lieu of the then existing Revenue-Cutter Service and the Life-Saving Service, and to be composed of those two organizations. It also provided that it shall constitute a part of the military forces of the United States, and shall operate under the Treasury Department in time of peace and as a part of the Navy, subject to the orders of the Secretary of the Navy, in time of war, or when the President shall so direct.

In general the duties of the Coast Guard may be classified as follows: Rendering assistance to vessels in distress and saving life and property; destruction or removal of wrecks, derelicts, and other floating dangers to navigation; extending

*This subject is so important that it forms a chapter in the first part with Lighthouses under the title of "Government Protection of Life and Property at Sea."



ICEBERG SIGHTED BY THE "SENECA" ON JUNE 8, 1916, IN LATITUDE 42.35 NORTH, LONGITUDE 49.36 WEST

medical aid to American vessels engaged in deep-sea fisheries; protection of the customs revenue; operating as a part of the Navy in time of war or when the President shall direct; enforcement of law and regulations governing anchorage of vessels in navigable waters; enforcement of law relating to quarantine and neutrality; suppression of mutinies on merchant vessels; enforcement of navigation and other laws governing merchant vessels and motor boats; enforcement of law to provide for safety of life on navigable waters during regattas and marine parades; protection of game and the seal and other fisheries in Alaska, etc.; enforcement of sponge-fishing laws.

To assist the Captain Commandant in conducting the business of his office there are established the following divisions:

Division of Operations—Having cognizance of matters relating to the personnel and operations of the service.

Division of Material—Having cognizance of matters relating to supplies, outfits, equipment, accounts, and the files.

Division of Construction and Repair—Having cognizance of matters relating to the construction of and repairs to the hulls of vessels and boats, stations, wharves, and all other property.

Division of Engineering—Having cognizance of matters relating to the construction of and repairs to the motive power of vessels and boats and the machinery of all other property.

Division of Inspection—Having cognizance of matters relating to the inspection of vessels, stations, boats, and all other property.

Under the direction of the Captain Commandant statistics are prepared regarding the loss of life and property on account of wrecked vessels in American waters. He is also required to acquaint himself, as far as practicable, with all means employed in foreign countries which may seem to affect advantageously the interests of the Coast Guard, and to cause to be properly investigated all plans, devices, and inventions for the improvement of life-saving apparatus for use at the stations which may appear to be meritorious and available. This is accomplished through the medium of the Board on Life-Saving Appliances, which meets annually at Boston, Mass., for that purpose.

OFFICE OF THE SUPERVISING ARCHITECT

Under the direction of the Secretary of the Treasury, the Supervising Architect acquires the sites and designs, constructs, equips, supplies, operates and repairs United States public buildings generally, marine hospitals and quarantine stations, and wharves, bridges, roads, sewers,

etc., in connection therewith. When specially authorized by law plans are obtained by competition among private architects. The Supervising Architect's Office was organized in 1853. Until 1861 an Army Engineer had charge of construction work; since then Supervising Architect in sole charge. Present organization: Supervising Architect, the Executive Officer, directing the administrative phases of the work and in charge of the Accounts, Maintenance, Repairs, and Files and Records Divisions, and Custodians' and Janitors' field force; the Technical Officer, directing the architectural and engineering work and in charge of the Drafting, Structural, Mechanical and Electrical Engineering, and Computing Divisions, Public Information Room, Duplicating and Photograph Galleries, and the Construction field force. Board of Award, composed of Supervising Architect, Executive Officer, Technical Officer and Superintendent of Drafting Division, passes upon and recommends all important expenditures (except for land).

Building work usually done by contract. Furniture and supplies generally obtained from manufacturers upon blanket annual contracts. Awards are to lowest best bidder, after advertising and public opening of bids. Supervising Architect approves materials and performance. Materials are tested by the National Bureau of Standards. Department orders land purchases and all expenditures from $500 upwards. Funds disbursed from Washington mainly. Each project supervised by resident superintendent; each finished building in charge of custodian. Operating force and field force overseen by traveling inspectors.

In 1853 the Supervising Architect had charge of 15 completed buildings and 28 to be constructed. In 1916 there are 1,073 completed public buildings, branch mints, assay offices, marine hospitals and quarantine stations; 117 separate projects under construction, 301 projects authorized, but not yet under construction; and 164 sites only (acquired or to be acquired) for which no buildings have yet been authorized.

The present headquarters force (quartered on the top floor of the Treasury Building) numbers 246. Field forces: Construction, 124; Operating force, about 5,000. The whole force of architects, engineers, draftsmen, computers, superintendents, inspectors, lawyers, accountants, stenographers, clerks, mechanics, janitors, etc., is within the classified civil service.

For the fiscal year ending June 30, 1915, the expenditures were:

Sites	$1,288,597.04
Construction	11,477,120.40
Repairs, etc.	1,347,303.67
Supplies and Operation...	5,951,546.99

UNITED STATES BUREAU OF WAR RISK INSURANCE

By Director William C. De Lanoy

The Bureau of War Risk Insurance was created by Act of Congress on September 2nd, 1914, to cover American vessels and their cargoes against the risks of war. It was to expire September 2nd, 1916, but on August 11th, 1916, was extended for a period of one year.

During the two years of this Bureau's existence it has covered war risk insurance on many vessels and cargoes where the market was small and without the assistance which was granted by the Bureau many of these vessels could not have sailed.

From September 2nd, 1914, to September 2nd, 1916, the Bureau issued 1,590 policies insuring ships and cargoes of a value of $145,831,602, for which the Government received in premiums $3,000,926.83, with a known loss to date of only $771,329.57, reduced through salvage

by the sum of $58,811.42, reducing the net loss to $712,518.15.

The expenses attending the conduct of the Bureau up to August 31st, 1916, a period of twenty-three months, have been $34,882.47. The Bureau has a list of ports to which the rates are not made public, but may be had upon application to the Bureau.

AUDITOR FOR THE TREASURY DEPARTMENT

The Auditor for the Treasury Department receives and settles all accounts of the Department of the Treasury, including all accounts relating to the customs service, the public debt, internal revenue, Treasurer and assistant treasurers, mints and assay offices, Bureau of Engraving and Printing, Coast Guard, Public Health Service, Farm Loan Board, public buildings and Secret Service.

AUDITOR FOR THE WAR DEPARTMENT

The Auditor for the War Department receives and settles all accounts of the Department of War, including those relating to the military establishment, armories and arsenals, national cemeteries, fortifications, public buildings and grounds under the supervision of the Chief of Engineers, rivers and harbors, the Military Academy and the Panama Canal.

AUDITOR FOR THE INTERIOR DEPARTMENT

All claims and accounts arising under the Department of the Interior, which includes those having relation to the protection, survey and sale of public and Indian lands, the reclamation of arid public and Indian lands, Army and Navy pensions, Indian affairs, Geological Survey, Bureau of Education, Bureau of Mines, Patent Office, Capitol Building and Grounds, Freedmen's Hospital, Howard University, Columbia Institution for the Deaf, Government Hospital for the Insane, Hot Springs Reservation, the Yosemite and other national parks, and the construction of railroads in Alaska, are settled in this office.

AUDITOR FOR THE NAVY DEPARTMENT

The Auditor for the Navy Department receives and settles all accounts of the Department of the Navy, including all accounts relating to the Naval Establishment, Marine Corps and the Naval Academy.

AUDITOR FOR THE STATE AND OTHER DEPARTMENTS

The Auditor for the State and Other Departments receives and settles the accounts of the White House; the two Houses of Congress; the Supreme Court; the Departments of State, including the expenses of the Diplomatic and Consular Service; Justice, covering expenses of United States courts; Agriculture, including its field service; Commerce; Labor; also the accounts of the following governmental establishments: Government Printing Office; Interstate Commerce Commission; Smithsonian Institution and National Museum; District of Columbia; Civil Service Commission; the Federal Reserve Board; the Federal Trade Commission; and all boards, commissions and establishments of the Government not under the administration of any executive department.

AUDITOR FOR THE POST OFFICE DEPARTMENT

The Auditor for the Post Office Department receives and examines all accounts of the office of the Postmaster General and of all bureaus and offices under his direction; all postal and money order accounts of postmasters and foreign administrations; all accounts relating to the transportation of mails, and to all other business within the jurisdiction of the Post Office Department; and certifies the balances arising thereon to the Postmaster General for accounts of the postal revenue and expenditures therefrom, and to the Secretary of the Treasury for other accounts. He also receives and examines reports and accounts of postmasters operating postal savings banks, and accounts for expenditures from the appropriation for continuing the establishment, maintenance, and extension of the postal savings depositories. He registers, charges and countersigns the warrants upon the Treasury issued in liquidation of indebtedness; superintends the collecting of debts due the United States for the service of the Post Office Department and all penalties imposed; directs suits and all legal proceedings in civil actions; and takes all legal measures to enforce the payment of money due the United States for the service of the Post Office Department, and for this purpose has direct official relations with the Solicitor of the Treasury, Department of Justice. He receives and accepts, with the written consent of the Postmaster General, offers of compromise under sections 295 and 409, Revised Statutes. He is required to submit to the Secretary of the Treasury quarterly statements of postal receipts and expenditures, and to report to the Postmaster General the financial condition of the Post Office Department at the close of each fiscal year.

CHAPTER VII.

DEPARTMENT OF WAR*

SECRETARY OF WAR

THE Secretary of War is head of the War Department, and performs such duties as are required of him by law or may be enjoined upon him by the President concerning the military service.

He is charged by law with the supervision of all estimates of appropriations for the expenses of the department, including the military establishment; of all purchases of Army supplies; of all expenditures for the support, transportation, and maintenance of the Army, and of such expenditures of a civil nature as may be placed by Congress under his direction.

He also has supervision of the United States Military Academy at West Point and of military education in the Army, of the Board of Ordnance and Fortification, of the various battlefield commissions, and of the publication of Official Records of the War of the Rebellion.

He has charge of all matters relating to national defense and seacoast fortifications, Army ordnance, river and harbor improvements, the prevention of obstruction to navigation, and the establishment of harbor lines; and all plans and locations of bridges authorized by Congress to be constructed over the navigable waters of the United States require his approval. He also has charge of the establishment or abandonment of military posts, and of all matters relating to leases, revocable licenses, and all other privileges upon lands under the control of the War Department.

ASSISTANT SECRETARY OF WAR

To the Assistant Secretary of War is assigned the general direction and supervision of all matters relating to rivers and harbors; bridges over navigable waters of the United States; leases, revocable licenses, and all other privileges upon lands under the control of the War Department; inspections relating to the military establishment; recruiting service, discharges, commutation of rations, courts-martial, and other questions relating to enlisted men, including clemency cases and matters relating to prisoners at military prisons and penitentiaries.

He also has charge of routine matters relating to the militia; the promotion of rifle practice; the supervision of miscellaneous claims and accounts; matters relating to national cemeteries, boards of survey, open-market purchases, and medals of honor.

The Assistant Secretary of War is also vested with authority to decide all cases which do not involve questions of policy, the establishment or reversal of precedents, or matters of special or extraordinary importance which may be assigned to him.

*A special chapter on the Army begins on page 281.

ASSISTANT AND CHIEF CLERK

The Assistant and Chief Clerk of the War Department is the head of the Office of the Secretary of War, and as such has charge of the records and files, and supervision of the receipt, distribution, and transmission of the official mail and correspondence of that office, and is charged with the administrative action required by law to be taken in connection with the settlement of disbursing officers' accounts that do not relate to the different staff corps of the Army. He has general supervision of matters relating to civilian employees in and under the War Department; printing and binding and advertising for the War Department and the Army; appropriations for contingent expenses, stationery, rent of buildings; and the department's telegraph and telephone service; and performs such other duties as may be required by the Secretary of War.

THE GENERAL STAFF CORPS, U. S. ARMY

The duties of the General Staff Corps, as stated in the organic act of Congress establishing it, are:

OFFICE OF THE CHIEF OF STAFF

The Chief of Staff is the military advisor of the Secretary of War. The Office of the Chief of Staff, for the purpose of carrying into effect the supervising, co-ordinating and informing powers conferred upon him by law, constitutes a supervising military bureau of the War Department.

The Chief of Staff issues, through the Adjutant General of the Army, all orders and instructions of the Secretary of War affecting the Regular Army and the National Guard.

FUNCTIONS OF THE GENERAL STAFF CORPS

The collation and discussion of all obtainable data relating to strategical, tactical and logistic features of military operations at home and abroad; the formulation of complete working plans for passing quickly from a state of peace to a state of war, including the mobilization of all the available military forces of the United States; also the preparation and keeping up to date of detailed plans of defensive and offensive operations against each country with which the United States might become involved in war.

The collection, classification and distribution of military information concerning (*a*) the strength, organization, personnel, armament and equipment of our own and foreign armies; (*b*) natural and artificial routes of communication (rivers, canals, roads and railroads); (*c*) the manufacture of arms, ammunition and other war materials; (*d*) supplies of food, horses, mules, pack and draft animals; (*e*) road vehicles, including motors and tractors.

The supervision of the work of military attaches and observers; the conduct of correspondence with them; inspection of their accounts and recommendations as to their detail and relief; the exchange of military information with foreign war offices through their representatives in Washington; the preparation of instructions for the guidance of officers of the Army serving or traveling abroad or acting as military attaches or observers, and the collation of information contained in their reports.

The collation, preservation, arrangement, filing and indexing of maps, sketches and plans, American and foreign; and the general supervision over the compilation of a progressive military map of the United States and its possessions.

The collection, preparation and distribution to the military service

of military information concerning our own and foreign countries.

The preparation, from official records, of analytical and critical histories of important campaigns for distribution to the Army.

The supervision and co-ordination of military education; training; plans for field maneuvers.

The study of the needs of the military service, and recommending changes therein; consideration of matters pertaining to armament, equipment and clothing; location, design and construction of posts.

The preparation of schemes of legislation for the increase of military preparedness, when directed by higher authority, for submission to Congress, and such other schemes of legislation for the improvement of the military service as may be directed.

The maintenance at the War College of a military library for the use of the War Department and the Army at large.

The conduct of a photographic laboratory for the reproduction of maps, sketches, photographs and illustrations, lantern slides and such other photographic work as may be required for the War Department and the Army at large.

THE ARMY WAR COLLEGE

The idea of a War College for the United States Army was first suggested by the Honorable Elihu Root, then Secretary of War, in his annual report for 1899. In the words of its founder, its purpose is "not to promote war, but to preserve peace by intelligent and adequate preparation to repel invasion. It is a growth and not a new departure. Only an institution permanent, but always changing in its individual elements, in which, by conference and discussion, a consensus of matured opinion can be reached, can perpetuate the result of individual effort, secure continuity of military policy, and command for its authorized conclusive expressions of military judgment, upon military questions, the respect and effectiveness to which that judgment is entitled."

The functions thus described are really those of a General Staff and it is worthy of note that the Army War College as first established by War Department order in 1901 performed the duties of such a body until the General Staff was actually created by Act of Congress in 1903.

WAR COLLEGE, WASHINGTON, D. C.

After that date the War College assumed its true function of training selected officers for staff duty and higher command in war, the controlling idea being that each class shall be a useful adjunct to the General

Staff in its study of the military problems affecting our country.

In order to accomplish this result, the year's work is made to include studies in the tactical and strategical handling of large bodies of troops, in the general control of the auxiliary services, and in offensive and defensive questions of military, as dependent upon national, policy. The course opens with map problems and map maneuvers of a practical nature, representing actual phases in military operations that might have to be undertaken by our forces in time of war. These studies are confirmed on the ground, whenever practicable, by terrain, tactical and staff rides. These problems are only sufficient to insure that ideas shall be uniform and that operations shall be conducted in accordance with an accepted doctrine of war. The remainder of the course includes a series of original investigations, studies of war plans, contributions to military monographs, studies in military geography, in methods of obtaining military information, and in military historical research. The final result is that each class contributes something of permanent value for future reference. This is possible only because the officers detailed to take the course are men of experience, preferably graduates of the Staff College at Fort Leavenworth, and well versed in the theory of their profession. The President of the Army War College is a general officer detailed to the General Staff as assistant to the Chief of Staff, and the faculty is selected from the graduates of the Army War College.

At first the sessions of the Army War College were held in a private residence rented for the purpose in Washington and this continued until 1907 when the present magnificent building on the site of the old Washington Barracks was first occupied. It provides quarters not only for the War College but also for the bulk of the General Staff on duty in Washington. The building, which cost about $700,000, is of modern construction and material but is purely classic in design. It is massive, well proportioned and impressive. In size the building is 300 feet long and 125 feet deep. The materials used in the construction of the exterior are red Pompeian pressed brick, laid in Flemish bond, with ornamentation of limestone and roof of dark slate.

Photo G. V. Buck

CONFERENCE ROOM, WAR COLLEGE

In the center of the front façade is the main entrance pavilion, consisting of a pedimental gable with massive piers on either side and beautifully proportioned Ionic columns in the center. The design of this entrance pavilion is duplicated at either end of the building. The portions of the structure flanking the pavilion are in the pilaster style of treatment. Great dignity is lent to the exterior by the approaches. Low granite steps lead to a wide platform paved with red brick laid in ornamental patterns. The building is one of the most artistic edifices in the country, and is considered to rival the Library of Congress in its technical perfection.

The interior is perfectly adapted to its purposes. Passing under the entrance pavilion, the visitor arrives in the large rotunda, with its four columns supporting an octagonal dome. Immediately beyond this is the main lecture room for the War

College, with a seating capacity of 250; to the right of the rotunda, in the center of the building, is the library, and to the left is the map room, both extending to the roof. On the long sides of the building are the various lecture and conference rooms, record rooms, work rooms and offices. The galleries of the library and map room are set aside for map drafting and mounting. The photographic department, complete for every kind of work, the workshops, store rooms and vaults are in the basement. The map room contains a magnificent collection of the military maps of all nations arranged for ready reference. The library contains more than 100,000 volumes, and its method of classification and card indexing, developed by the present Assistant Librarian, is considered to be the most remarkable and complete system of its kind for ready reference in this country.

Photo Harris & Ewing

ARMY WAR GAME BEING PLAYED AT THE WAR COLLEGE BY DISTINGUISHED ARMY OFFICERS

MILITIA BUREAU

The Militia Bureau is vested with all administrative duties involving the organization, armament, instruction, equipment, discipline, training, inspection, and payment of the National Guard; the conduct of camps of instruction of the National Guard, and the administrative duties connected with the preparation of the National Guard for participation in field exercises and maneuvers of the Regular Army; the mobilization of the National Guard in time of peace; and all matters not herein generically enumerated which do not under existing laws, regulations, orders, or practice come within the jurisdiction of the General Staff or any division or bureau of the War Department.

MILITARY BUREAUS

THE CHIEFS OF THE MILITARY BUREAUS OF THE WAR DEPARTMENT ARE OFFICERS OF THE REGULAR ARMY OF THE UNITED STATES AND A PART OF THE MILITARY ESTABLISHMENT

OFFICE OF THE ADJUTANT GENERAL

The Adjutant General is charged with the duty of recording, authenticating, and communicating to troops and individuals in the military service all orders, instructions, and regulations issued by the Secretary of War through the Chief of Staff, or otherwise; of preparing and distributing commissions; of compiling and issuing the Army Register and the Army List and Directory; of consolidating the general returns of the Army; of arranging and preserving the reports of officers of the Army detailed to visit encampments of militia; of compiling and maintaining a list showing the names of officers of the Army on detached service; of managing the recruiting service, and of conducting correspondence concerning the military service generally, including such as pertains to military training camps, rifle practice, the Officers' Reserve Corps, the Reserve Officers' Training Corps and the Enlisted Reserve Corps. He is also vested with the government and control, under the direction of the Secretary of War, of the United States Disciplinary Barracks and its branches, and all offenders sent thereto for confinement and detention; and is charged with the duty of issuing and recording orders from the War Department remitting or mitigating sentences of general prisoners, or honorably restoring them to duty. The Adjutant General is vested by law with the charge, under the Secretary of War, "of the military and hospital records of the volunteer armies and the pension and other business of the War Department connected therewith;" of publishing War Department regulations, manuals and miscellaneous documents pertaining to the military service and distributing to the Army such publications, as well as those publications of a private nature as are useful in the military establishment; of publishing and distributing the Official Records of the Union and Confederate Armies; of obtaining, compiling and keeping continually up to date all obtainable information as to the names, ages, addresses, occupations and qualifications for appointment as commissioned officers of the Army, in time of war or other emergency, of men of suitable ages who, by reason of having received military training in civilian educational institutions or elsewhere, may be regarded as qualified and available for appointment as such commissioned officers; and of issuing certificates of enlistment in the Enlisted Reserve Corps. He also has charge of the historical records and business of the permanent military establishment, and all pension, pay, bounty, and other business pertaining to or based upon the military or medical histories of former officers or enlisted men, including the consideration of applications for the Congressional Medal of Honor; for the benefits of the act of Congress approved April 27, 1916, establishing the Army and Navy Medal of Honor Roll; for certificates of military service, certificates of merit, and certificates authorizing the purchase of campaign badges, and for removal of charges of desertion and the issue of discharge certificates to such soldiers finally charged with desertion as are entitled to relief under the terms of existing law. The archives of the Adjutant General's office include all military records of the Revolutionary War in the possession of the General Government; the records of all organizations, officers, and enlisted men that have been in the military service of the United

States since the Revolutionary War, including those pertaining to the volunteer forces and the National Guard while in the active service of the United States; the records of the movements and operations of troops; the medical and hospital records of the Army; all reports of physical examination of recruits and identification records; the records of the Provost Marshal General's Bureau; the records of the Bureau of Refugees, Freedmen, and Abandoned Lands; and a considerable collection of Confederate records, including those pertaining to the legislative, executive, and judicial branches of the Confederate Government.

OFFICE OF THE INSPECTOR GENERAL

The duty of the officers of the Inspector General's Department is to inspect the Army in all its details, and the scope of their inquiry includes every branch of military affairs. They exercise a comprehensive and general observation within the commands to which they are assigned over all that pertains to the efficiency of the Army, the condition and state of supplies of all kinds, of arms and equipments, of the expenditure of public property and money, and the condition of accounts of all disbursing officers of every branch of the service; of the conduct, discipline and efficiency of officers and troops, and report with strict impartiality in regard to all irregularities that may be discovered, with a view to their being remedied. They also inspect the Soldiers' Home, the ten branches of the National Home for Disabled Volunteer Soldiers, the Army transports and National Guard; and make investigations ordered by the Secretary of War or Department Commanders.

OFFICE OF THE JUDGE ADVOCATE GENERAL

The Judge Advocate General is directed by law to "receive, review, and cause to be recorded the proceedings of all courts-martial, courts of inquiry, and military commissions." He reports upon applications for clemency, parole, pardon, restoration to the colors, remission of citizenship rights, and re-enlistment of general prisoners and dishonorably discharged soldiers. He also furnishes the Secretary of War information and advice relating to lands under the control of the War Department, as well as reports and opinions upon legal questions arising under the laws, regulations, and customs pertaining to the Army, and upon miscellaneous questions arising under civil law; examines and prepares legal papers relating to the construction of bridges, dams, or other work over or in navigable waters; drafts bonds and examines those given to the United States by disbursing officers, colleges, rifle clubs, and others; examines, revises, and drafts charges against officers and soldiers; and drafts and examines deeds, contracts, licenses, and other legal papers relating to matters under the War Department

OFFICE OF THE QUARTERMASTER GENERAL

Under the provisions of the Revised Statutes, Statutes at Large, current appropriation acts, and Army Regulations, the Quartermaster General is charged with the following duties:

(*a*) Pay of officers and enlisted men of the Army, including Staff Corps and Staff Departments, Porto Rico Regiment of Infantry and Philippine Scouts; additional pay for length of service and foreign service; pay of retired officers and retired enlisted men; pay of Regular Army Reserve, Officers' Reserve Corps, Enlisted Men's Reserve; mileage; commutation of quarters for commissioned officers and vet-

erinarians; pay of nurses, hospital matrons, veterinarians of Cavalry and Field Artillery and Quartermaster Corps, contract surgeons and retired pay clerks; expenses of courts martial, courts of inquiry, military commissions, and compensation of reporters and witnesses attending same; travel allowance to enlisted men on discharge; value of clothing undrawn to enlisted men on discharge; interest on soldiers' deposits; receiving and paying deposits of enlisted men; gratuity pay.

(*b*) Purchase of subsistence supplies for issue as rations to troops, civil employees, hospital matrons, and others entitled thereto; subsistence of masters, officers, crews, and employees of the Army Transport Service; hot coffee for troops traveling when supplied with cooked or travel rations; meals for recruiting parties and applicants for enlistment while held under observation; for sales to officers; commutation of rations to the Cadets of the United States Military Academy; commutation in lieu of rations to enlisted men on furlough, enlisted men and male and female nurses when stationed at places where rations in kind can not be economically issued and when traveling on detached duty, enlisted men selected to contest for places or prizes in Army rifle competitions while traveling to and from place of contest, male and female nurses on leaves of absence, applicants for enlistment, and general prisoners while traveling under orders; commutation in lieu of regular established ration for members of Nurse Corps (female) while on duty in hospitals, and for enlisted men, applicants for enlistment while held under observation, and general prisoners sick in hospitals; prizes for enlisted men graduates of schools for bakers and cooks; authorized issues of soap, candles, matches, and salt and vinegar for animals; towels for offices; authorized issues of toilet paper, toilet articles, barbers' and tailors' materials for use of general prisoners confined at military posts without pay or allowances, and applicants for enlistment while held under observation; issue of toilet kits to recruits; for other necessary expenses incident to the purchase, testing, care, preservation, issue, sale, and accounting for subsistence supplies; for purchase, issue, repair and maintenance of stoves, ranges, field ranges, field bakeries, and appliances for cooking and serving food to troops in garrison and in the field; tableware, kitchen utensils, and mess furniture, stationery for the Army, including blank books, blank forms, and the necessary printing; purchase, issue, repair and maintenance of prescribed field equipment and supplies for garrison use; purchase and issue of ice for use of troops, offices, and preservation of stores; providing cold storage; construction and maintenance of ice plants, laundries, post bakeries, and power plants for lighting, and for supply of water; purchase and issue of water bags, sterilizers and necessary chemicals for purifying water; purchase and issue of fuel for heating barracks, quarters and other public buildings and for cooking food; fuel for operation of modern batteries, pumping and other power plants; fuel for operation of transports and harbor vessels of the Army; furnishing light, including mineral oil; necessary furniture, text books, paper, and other equipment for post schools and libraries; subscriptions for newspapers and periodicals for the enlisted men; forage for the animals of the Army, including bedding; purchase and issue of typewriters, adding machines, addressographs and other devices for use of the Army; seeds and implements for raising forage at remount depots; hire of all employees pertaining to the Quartermaster Corps; extra duty pay for members of disciplinary barracks guard, to enlisted men on duty as school teachers and stewards and cooks at recruit depots; purchase and issue of office furniture and

office equipment; payment of rewards for apprehension of deserters and escaped military prisoners; donations of $5 to dishonorably discharged prisoners; purchase and issue of blacksmiths' tools and materials, horse and mule shoes, horseshoe nails, wheelwrights' and other tools; purchase and supply of flagstaffs, surveying instruments, refrigerators, wall lockers, trunk lockers, window shades, screen doors and window screens; purchase and issue of animals for the Army; equipment and maintenance of remount depots; purchase, issue, and repair, maintenance and operation of wagons, motor vehicles, and other vehicles; purchase, manufacture, and issue of harness and pack equipment; purchase and manufacture of uniforms for the Army; purchase and issue of other articles of clothing; purchase and manufacture of tentage and other articles of equipage; purchase and issue of technical books; transportation of troops and impedimenta; transportation of civilian employees, of baggage of officers, troops and employees; transportation of animals for the Army; transportation of Army supplies; transportation of funds; payment of wharfage, tolls, and ferriage; construction, operation, and maintenance of harbor vessels for the Mobile Army and for the Coast Artillery, including mine planters and cable ships; operation and maintenance of Army Transport Service on the Pacific and Atlantic Oceans and the Gulf of Mexico; charter of vessels for transport purposes; lease of buildings for quarters, storehouses and offices; lease of grounds for camp sites; hire of lodgings for recruits; care and protection of military reservations; care and maintenance of post cemeteries and national cemeteries; care and improvement of grounds at military posts; and attends to all matters connected with the military service which are not expressly assigned to some other bureau of the War Department.

(*c*) Constructs and repairs quarters for officers, barracks for enlisted men, storehouses for storage of supplies, administration buildings, offices, power plants, roads, walks, wharves, water systems, sewer systems and drainage systems; acquires land for military purposes.

OFFICE OF THE SURGEON GENERAL

The Surgeon General is the adviser of the War Department upon all medical and sanitary affairs of the Army. He has administrative control of the Medical Department; the disbursement of its appropriations; the designation of the stations of medical officers, dental officers and veterinary surgeons, and the issuing of all orders and instructions relating to their professional duties; the recruitment, instruction and control of the Hospital Corps and of the Army Nurse Corps. He directs the selection, purchase and distribution of medical supplies. The Army Medical Museum, the library of the Surgeon General's Office, medical supply depots, and the general hospitals are under his direct control.

OFFICE OF THE CHIEF OF ENGINEERS

The Chief of Engineers commands the Corps of Engineers, which is charged with reconnoitering and surveying for military purposes, including the laying out of camps, selection of sites, and formation of plans and estimates for military defenses, construction and repair of fortifications and their accessories, the installation of electric-power plants and electric-power cable connected with seacoast batteries, and furnishing the necessary electrical supplies connected therewith; planning and superintending of defensive or offensive works of troops in the field; examination of routes of communications for supplies and for

military movements; construction and repair of military roads, railroads and bridges; and military demolitions. In time of war, within the theater of operations, it has charge of the location, design, and construction of wharves, piers, landings, storehouses, hospitals, and other structures of general interest; and of the construction, maintenance, and repair of roads, ferries, bridges, and incidental structures; and of the construction, maintenance, and operation of railroads under military control, including the construction and operation of armored trains.

The Corps of Engineers is also charged with the improvement of rivers and harbors; with matters arising under the laws for the protection and preservation of navigable waters, including the establishment of harbor lines, anchorage grounds, and rules and regulations therefor; rules and regulations for canals owned, operated, or maintained by the United States, for any public navigable channel improved under authority of Congress, and for the navigation of streams on which the floating of loose timber and sack rafts is the principal method of navigation; also with the issuance of permits for the construction, alteration, maintenance, and operation of bridges, the granting of permits for structures or work in navigable waters, and the removal of wrecks and other obstructions to navigation; with questions pertaining to the supervision of the harbor of New York and adjacent waters to prevent obstructive and injurious deposits; with surveying and charting the Great Lakes, the natural navigable waters of the New York State canals, Lake Champlain, the Lake of the Woods, and other boundary and connecting waters between said lake and Lake Superior; with the preservation of Niagara Falls; with public buildings and grounds in the District of Columbia; with the water supply of Washington, D. C.; with the construction of monuments and memorials; and with the construction of roads and bridges in the Yellowstone and Crater Lake National Parks.

OFFICE OF THE CHIEF OF ORDNANCE

The Chief of Ordnance commands the Ordnance Department, the duties of which consist in providing, preserving, distributing, and accounting for every description of artillery, small arms, and all the munitions of war which may be required for the fortresses of the country, the armies in the field, and for the whole body of the militia of the Union. In these duties are comprised that of determining the general principles of construction and of prescribing in detail the models and forms of all military weapons employed in war. They comprise also the duty of prescribing the regulations for the proof and inspection of all these weapons, for maintaining uniformity and economy in their fabrication, for insuring their good quality, and for their preservation and distribution at all times.

BOARD OF ORDNANCE AND FORTIFICATION

The Board of Ordnance and Fortification was created in 1888 to assist in the development of war material, especially that pertaining to ordnance and fortification. The board has an appropriation from Congress for carrying out the development and test of inventions for which no special provision is otherwise made, and considers a very large number of inventions submitted by civilians, as well as persons in the military service, each year. A large amount of very important development work has been carried on under the board and the board is glad to have submitted to it any inventions relating to military subjects.

The membership of the board consists of six senior Army officers, representing various technical branches of the service, and of one civilian.

OFFICE OF THE CHIEF SIGNAL OFFICER

The Chief Signal Officer is charged with the duty of operating or supervising the operation of all military air craft and with the duty of training officers and men connected therewith; with the supervision of all military signal duties, and of books, papers, and devices connected therewith, including telegraph, telephone, and radio apparatus and the necessary meteorological instruments for use on target ranges and other military uses; the construction, repair, and operation of military telegraph lines and cables, and the duty of collecting and transmitting information for the Army by telegraph or otherwise, and all other duties usually pertaining to military signaling.

OFFICE OF PUBLIC BUILDINGS AND GROUNDS

The Office of Public Buildings and Grounds, Washington, D. C., is the successor of the Commissioners of Public Buildings and Grounds, established in 1792 under the direction of President Washington, and is now a bureau of the War Department. The United States Army Engineer Officer in Charge is Military Aide to the President. He administers the public park system of the District of Columbia for the Chief of Engineers, United States Army, under whose jurisdiction and control it has been placed by law; this park system comprises over 400 parcels of Federal property, amounting in all to over 1100 acres, and includes the Mall System as proposed by L'Enfant and elaborated by the Park Commission of 1901. He is in charge of the preservation, care and safety of all the buildings occupied by the War Department, of the Highway Bridge across the Potomac and of the monument at the birthplace of Washington. As Executive and Disbursing Officer of the Grant Memorial Commission, of the Lincoln Memorial Commission, of the Arlington Memorial Amphitheater Commission and of the Francis Scott Key Monument Commission (which monument is to be erected at Fort McHenry, Baltimore, Md.), he supervises and controls the erection of those memorials. As Executive and Disbursing Officer of the Rock Creek and Potomac Parkway Commission he has the development of that project under his charge. He is a member and disbursing officer of the commission to prepare plans and estimates for an armory for the National Guard of the District of Columbia, and he is Executive and Disbursing Officer of the Arlington Memorial Bridge Commission.

BUREAU OF INSULAR AFFAIRS

Following the Spanish-American War the War Department was confronted with varied and complex problems in the administration of the civil affairs of the territory occupied by the military forces of the United States. There were no precedents to which the officers charged with the administration of the affairs of this territory could turn for guidance, and the difficulties of these officers were further complicated owing to the lack of any administrative machinery for handling these problems. Notwithstanding the frequency in the past with which the War Department had been called on to conduct military governments and civil governments during military occupation, there had existed in the department no bureau or division to which in a

particular manner was committed this work of supervision. The then Secretary of War, recognizing the urgent need of such a bureau or division, organized, in December, 1898, the Division of Insular Affairs. The rapid growth of the division thus organized led to its being given a legal existence July 1, 1902, and since that date has been known as the Bureau of Insular Affairs.

To the Bureau of Insular Affairs, under the immediate direction of the Secretary of War, is assigned all matters pertaining to civil government in the island possessions of the United States subject to the jurisdiction of the War Department, the Philippine Islands and Porto Rico being the only ones so subject at the present time. The bureau is also the repository of the civil records of the government of occupation of Cuba, and had assigned to it matters pertaining to the provisional government of Cuba. It makes a comptroller's review of the receipts and expenditures of the Philippine and Porto Rican governments; attends to the purchase and shipment of supplies for these governments; has charge of appointments of persons in the United States to the civil service of the Philippines and Porto Rico, including arrangements for transportation. It gathers statistics of insular imports and exports, shipping and immigration, and issues periodical summaries of the same. In addition the bureau has, subject to the direction of the Secretary of State, supervision and control of the Dominican Receivership for the collection of customs revenues and payment of the interest and principal of the adjusted bonded indebtedness of the Dominican Republic. It exercises for the receivership practically the same functions as it does for the insular possessions, particularly with respect to the custody of records, the preparation and dissemination of statistics and other information, the purchase of supplies and the appointment of employees.

BOARD OF ENGINEERS FOR RIVERS AND HARBORS

The Board of Engineers for Rivers and Harbors is a permanent body, created by the River and Harbor Act of June 13th, 1902. To it are referred all reports upon examinations and surveys provided for by Congress, and all projects or changes in projects for works of river and harbor improvement upon which report is desired by the Chief of Engineers, United States Army. It is further the duty of the Board, upon request by the Committee on Commerce of the Senate, or by the Committee on Rivers and Harbors of the House of Representatives in the same manner, to examine and report through the Chief of Engineers upon any examinations, surveys, or projects for the improvement of rivers and harbors. In its investigations the board gives consideration to all engineering, commercial, navigation and economic questions involved in determining the advisability of undertaking such improvements at the expense of the United States.

OFFICE OF THE CHIEF OF COAST ARTILLERY

1. It is the duty of the Chief of Coast Artillery to keep the Chief of Staff advised and informed with respect to the business under his charge, including the efficiency of the personnel and material of the coast artillery, and he shall, as circumstances require, make such recommendations in reference thereto as shall in his judgment tend to promote efficiency.

2. He shall from time to time, and as frequently as conditions require, confer directly with the chiefs of bureaus of the War Department and advise them of all matters relating to coast artillery material or personnel that pertain to their re-

spective branches of the service, which the experience and observation of the coast artillery arm of the service show to be of practical importance. In like manner he may correspond directly with the commandant of the Coast Artillery School, and with the president of the Coast Artillery Board, on coast artillery questions of a purely technical character which do not involve matters of command, discipline, or administration, and do not relate to the status or interests of individuals.

3. He shall make recommendations as to the instruction of coast artillery officers and men, and as to examinations for appointment and transfer of officers to the coast artillery arm and for promotion therein, and shall recommend such examinations and such courses and methods of instruction in the Coast Artillery School and elsewhere as he shall deem requisite to secure a thoroughly trained and educated force; to this end he is authorized to issue directly to coast artillery officers bulletins and circulars of information on current coast artillery matters of a purely technical character which do not involve matters of command, discipline, or administration, and do not relate to the status or interests of individuals.

4. He is charged with the recommending of officers of coast artillery for special duty and assignment to coast artillery organizations and stations.

5. He shall be a member of the Board of Ordnance and Fortification and is by law a member of the General Staff Corps.

CHAPTER VIII.

DEPARTMENT OF JUSTICE

ATTORNEY GENERAL

THE Attorney General is the head of the Department of Justice and the chief law officer of the Government. He represents the United States in matters involving legal questions; he gives his advice and opinion, when they are required by the President or by the heads of the other executive departments, on questions of law arising in the administration of their respective departments; he appears in the Supreme Court of the United States in cases of especial gravity and importance; he exercises a general superintendence and direction over United States attorneys and marshals in all judicial districts in the States and Territories; and he provides special counsel for the United States whenever required by any department of the Government.

SOLICITOR GENERAL

The Solicitor General assists the Attorney General in the performance of his general duties, and, by special provision of law, in case of a vacancy in the office of the Attorney General, or of his absence or disability, exercises all those duties. Under the direction of the Attorney General, he has general charge of the business of the Government in the Supreme Court of the United States, and is assisted in the conduct and argument of cases therein by the Assistant Attorneys General. He also, with the approval of the Attorney General, prepares opinions rendered to the President and the heads of the executive departments, and confers with and directs the law officers of the Government throughout the country in the performance of their duties. When the Attorney General so directs, any case in which the United States is interested, in any court of the United States, may be conducted and argued by the Solicitor General; and he may be sent by the Attorney General to attend to the interests of the United States in any State court, or elsewhere. Performs such other duties as may be required.

THE ASSISTANT TO THE ATTORNEY GENERAL

The Assistant to the Attorney General has special charge of all suits and other matters arising under the Federal anti-trust and interstate-commerce laws, and performs such other duties as may be required of him, from time to time, by the Attorney General.

ASSISTANT ATTORNEYS GENERAL

The several Assistant Attorneys General assist the Attorney General in the performance of his duties. They assist in the argument of cases in the Supreme Court and in the preparation of legal opinions.

Five Assistant Attorneys General are located in the main department building at 1435 K Street, and, in addition to their general duties, particular subjects are assigned to them by the Attorney General for the transaction of business arising thereunder with United States attorneys, other departments, and private parties in interest.

The office of the Assistant Attorney General, including a number of assistant attorneys and clerks charged with defending suits in the Court of Claims, is located at 8 Jackson Place.

The Assistant Attorney General in charge of the interests of the Government in all matters of reappraisement and classification of imported goods in litigation before the several boards of United States General Appraisers and the Court of Customs Appeals, is located at 641 Washington Street, New York.

The Assistant Attorneys General and the solicitors for the several executive departments exercise their functions under the supervision and control of the Attorney General. They are the Solicitor for the Department of the Interior, the Solicitor for the Department of State, the Solicitor of the Treasury, the Solicitor of Internal Revenue, the Solicitor of the Department of Commerce, and the Solicitor of the Department of Labor.

PUBLIC LANDS DIVISION

To it are assigned all suits and proceedings concerning the enforcement of the public-land law, including all suits or proceedings to set aside conveyances of allotted public lands.

CHIEF CLERK

The chief clerk, under the direction of the Attorney General, has general supervision of the clerks and employees; the consideration of applications for leave of absence; the direction of the force of laborers, charwomen and watchmen; superintends all buildings occupied by the department in Washington; has charge of the horses, wagons and carriages employed; has supervision of the Division of Mails and Files; the purchase and distribution of supplies for the department and the United States courts; the expenditure of the appropriations for contingent expenses and rents; the consideration of requisitions upon the Public Printer for printing and binding; and supervision of the preparation of the annual report and the estimates of the department.

DISBURSING CLERK

The disbursing clerk disburses from about forty appropriations, under the direction of the Attorney General, including the salaries of the Justices of the Supreme Court of the United States and the judges of the other United States courts located in the District of Columbia; the salaries of the officials of the department proper, as well as the salaries and expenses of certain employees stationed in the field; the contingent expenses of the department: supplies for United States courts; and other special and miscellaneous appropriations. He is also authorized and directed by law to withhold and account for the income tax as it may apply to Federal employees.

SUPERINTENDENT OF PRISONS

The superintendent of prisons has charge, under the direction of the Attorney General, of all matters relating to United States prisons and prisoners, including the support of such prisoners in both State and Federal penitentiaries, in reform schools and in county jails. He has supervision over the construction work in progress at United States penal institutions.

The superintendent of prisons is president of the boards of parole for the

United States penitentiaries and president of the boards of parole for United States prisoners in each State or county institution which, from time to time, may be used for the confinement of United States prisoners.

APPOINTMENT CLERK

The appointment clerk has charge of all matters relating to applications, recommendations, and appointments, including certifications by the Civil Service Commission; conducts correspondence pertaining thereto; prepares nominations sent to the Senate; prepares commissions and appointments for the officers and employees of the department in Washington, and for United States judges, attorneys, and marshals and other officers under the department. He also compiles the Register of the Department of Justice and matter relating to that department for the Official Register of the United States.

ATTORNEY IN CHARGE OF PARDONS

The attorney in charge of pardons takes charge of all applications for Executive clemency, except those in Army and Navy cases, these being referred to the Secretary of War and the Secretary of the Navy, respectively; of the briefing of the cases and the correspondence in relation to them.

ATTORNEY IN CHARGE OF TITLES

The attorney in charge of titles prepares opinions upon the title to lands belonging to or sought to be acquired by the Government for public purposes and opinions upon all legal matters growing out of the same. He has charge of all proceedings to acquire land under eminent domain, and conducts all the correspondence relating to the above matters.

CHIEF OF THE DIVISION OF ACCOUNTS

The Chief of the Division of Accounts has charge of the examination or audit of all accounts payable from appropriations for expenses of the Department of Justice and the courts of the United States. Accounts of United States marshals, attorneys, clerks, and commissioners are examined, recorded, and transmitted to the auditor; while other accounts are recorded, audited, and transmitted to the disbursing clerk for payment, under recent legislation.

Authorization of court expenses, including items for office expenses and clerical assistants for clerks of United States courts; the approval of leases of court accommodations; and the advancement of funds to United States marshals; also matters relating to the appointment of office and field deputy marshals are in charge of the chief of this division.

Statistical information published in the annual report of the Attorney General showing the business transacted in the courts of the United States, bankruptcy statistics, and the various reports required by law pertaining to expenditures under appropriations for the courts and the various divisions of the department are also compiled in this division.

CHIEF OF THE DIVISION OF INVESTIGATION

The Chief of the Division of Investigation has general supervision of the examination of the offices and records of the Federal court officials throughout the United States, and directs the work of all the examiners, special agents, and accountants of the department, whose compensation or expenses are paid from the appropriation "Detection and prosecution of crimes," and who are employed for the purpose of collecting evidence or of making investigations or examinations of any kind for this department or the officers thereof.

LIBRARIAN

The librarian has general charge and supervision of the library. He is a member of the committee for the selection of books to be purchased for the library, directs the cataloguing, and co-operates generally in the service of the library.

CHAPTER IX.

POST OFFICE DEPARTMENT*

POSTMASTER GENERAL

THE Postmaster General is the executive head of the Federal Postal Service. He appoints all officers and employees of the Post Office Department except the four Assistant Postmasters General and the purchasing agent, who are Presidential appointees. With the exception of postmasters of the first, second and third classes, who are likewise Presidential appointees, he appoints all postmasters and all other officers and employees of the service at large. Subject to the approval of the President, he makes postal treaties with foreign Governments. He promulgates all rules and regulations; superintends generally the business of the department, and executes all laws relative to the postal service. Much information is contained in his annual report.

CHIEF CLERK

The chief clerk of the Post Office Department is charged with the general superintendence and assignment of the clerical and subclerical forces of the department and the consideration of applications for leave of absence for such employees; the supervision of the preparation of estimates of appropriations for the departmental and postal service; of advertising; the supervision of requisitions upon the Treasury and the expenditure of the appropriations for the departmental service; the keeping of the journals and order books; the furnishing of stationery supplies for the departmental service; the consideration and signing of requisitions upon the Public Printer for the printing and binding required in the Postal Service and the department, and receiving, and inspecting on receipt, of blanks required in the Post Office Department; the preparation of contracts and general superintendence of the publication and distribution of the Official Postal Guide; the fixing of rates, subject to the approval of the Postmaster General, for the transmission of Government telegrams; the miscellaneous business correspondence of the Postmaster General's Office, and miscellaneous correspondence of the department not assigned to other offices; the care of the department and other buildings used in connection therewith, and of all furniture and public property therein; and the performance of such other duties as may be required by the Postmaster General.

SOLICITOR FOR THE POST OFFICE DEPARTMENT

The solicitor is charged with the duty of giving opinions to the Postmaster General and the heads of the several offices of the department upon questions of law arising upon the construction of the postal laws and regulations, or otherwise, in the course of business in the Postal Service; with the consideration and submission (with advice) to the Postmaster General of all claims of postmasters for losses by fire, burglary, or other unavoidable casualty, and of all certifications by the Auditor for the Post Office Department of cases of proposed compromise of liabilities to the United States, and of the remission of fines, penalties, and forfeitures under the statutes; with the giving of advice when desired in the preparation of correspondence with the Department of Justice and other departments, including the Court of Claims, involving questions of law or relating to prosecutions or suits affecting or arising out of the

*There is a special chapter on the Post Office, page 161.

Postal Service, and with assisting when desired in the prosecution or defense of such cases, and the maintenance of suitable records of opinions rendered affecting the Post Office Department and the Postal Service; and with the consideration of applications for pardon for crimes committed against the postal laws which may be referred to the department; with the preparation and submission (with advice) to the Postmaster General of all appeals to him from the heads of the offices of the department depending upon questions of law; with the determining of questions as to the delivery of mail the ownership of which is in dispute; with the hearing and consideration of cases relating to lotteries and the misuse of the mails in furtherance of schemes to defraud the public; with the consideration of all questions relating to the mailability of alleged indecent, obscene, scurrilous, or defamatory matter; with determining the legal acceptability of securities offered by banks to secure postal savings deposits; with the examining and, when necessary, drafting of all contracts of the department; and with such other like duties as may from time to time be required of him by the Postmaster General.

PURCHASING AGENT

The purchasing agent supervises the purchase of all supplies both for the Post Office Department proper and for all branches of the Postal Service. He reviews all requisitions and authorizations for supplies and, if proper, honors the same. He passes upon the sufficiency and propriety of all specifications for proposals for supplies; prepares the advertisements and forms for proposals necessary to the making of contracts for supplies; reviews the reports of the committees on awards and recommends to the Postmaster General such action as in his judgment should be taken thereon.

CHIEF INSPECTOR

The chief inspector supervises the work of post office inspectors and of the division of post office inspectors. To him is charged the preparation and issue of all cases for investigation, all matters relating to depredations upon the mails and losses therein, the custody of money and property collected or received by inspectors, and the restoration thereof to the proper parties or owners, and the consideration and adjustment of accounts of inspectors for salary and expenses. To his office are referred all complaints of losses or irregularities in the mails and all reported violations of the postal laws.

FIRST ASSISTANT POSTMASTER GENERAL

The First Assistant Postmaster General has charge of the following divisions, to which are assigned the duties specified:

Post Office Service.—The organization of post offices, salaries of postmasters, the appointment and salaries of assistant postmasters, supervisory officers, clerks, and city letter carriers, authorization of new or changes in existing service on pneumatic tube routes, and Government-owned automobile routes, establishment of mail messenger and regulation, screen, or other wagon service, the performance of service by contractors on such routes and complaints concerning the same, Government-owned automobile service, the establishment, maintenance and extension of city delivery-and-collection service, and all matters concerning special delivery service. Allowances for rent, light, fuel, clerk hire, labor incident to cleaning post offices, telephone rental, water rental, laundering, towel service, and miscellaneous service items.

Postmasters' Appointments.—The appointment of a postmaster, to postmasters' bonds and commissions, bonds of all employees in post offices except rural carriers and village delivery carriers, leave of absence of postmasters, and the establishment, discontinuance, or change of site, of a fourth-class post office.

Dead Letters.—The treatment of all unmailable and undelivered mail matter which is sent to it for disposition; the examination and forwarding or return of all letters which have failed of delivery; the inspection and return to the country of origin of undelivered foreign matter; recording and restoration to owners of letters and parcels which contain valuable inclosures; care and

disposition of all money, negotiable paper, and other valuable articles found in undelivered matter and correspondence, both foreign and domestic, relating to these subjects.

SECOND ASSISTANT POSTMASTER GENERAL

The Second Assistant Postmaster General has charge of the authorization of new or changes in existing steamboat, aviation and Alaska star route services.

Railway Adjustments.—Has charge of the preparation of cases authorizing the transportation of mails by railroads; the establishment of railway postal car service and changes in existing service; prepares orders and instructions for the weighing of the mails on railroads; receives and tabulates the returns and computes basis of pay therefrom; prepares cases for adjustment of allowances to railroads for carrying the mails, and for postal cars; authorizes expenditures and credits for the weighing of the mails, and transportation by freight or express of postal cards, stamped envelopes, periodical mail matter and mail equipment; and prepares all correspondence relative to these matters.

Foreign Mails.—Is charged with the duty of arranging all details connected with the transportation of foreign mails; the preparation of postal conventions (except those relative to the money-order system) and the regulations for their execution, as well as the consideration of the questions arising under them and with the preparation of all correspondence relative thereto. Also has supervision of the ocean mail service, including the adjustment of accounts with steamship companies for the transportation of mails to foreign countries.

Railway Mail Service.—Is charged with the supervision of the Railway Mail Service and railway postal clerks; prepares cases for the appointment, removal, promotion, and reduction of said clerks; conducts correspondence and issues orders relative to the moving of the mails on railroad trains; has charge of the dispatch and distribution of mail matter in railway postal cars and post offices; conducts the weighing of mails; and attends to all correspondence relative to these matters.

THIRD ASSISTANT POSTMASTER GENERAL

The Third Assistant Postmaster General has charge of the following divisions, to which are assigned the duties specified:

Finance.—The financial operations, including the collection and deposit of postal revenues; the distribution of postal funds among the several depositaries so as to equalize, as far as possible, receipts and expenditures in the same section; the payment by warrant of all accounts settled by the auditor; the receipt and disposition of all moneys coming directly to the department; and the keeping of books of account showing the fiscal operations of the postal and money-order services and the regulation of box rents and key deposits.

Stamps.—The supervision of the manufacture and issuance to postmasters of postage stamps, stamp books, stamped envelopes, newspaper wrappers, postal cards, and postal saving stamps and cards by the various contractors; and the keeping of the accounts and records of these transactions. The receipt and disposition of damaged and unsalable stamped paper returned by postmasters for redemption and credit.

Money Orders.—The supervision and management of the money-order service, both domestic and international; the preparation of conventions for the exchange of money orders with foreign countries.

Registered Mails.—The supervision and management of the registry, in-

surance, and collect-on-delivery services; the establishment and control of all registry dispatches and exchanges; the instruction of postmasters and the furnishing of information in relation to these matters; and the consideration of all claims for indemnity for lost registered, insured, and C. O. D. mail.

Classification.—The general control of all business relating to the classification of domestic mail matter and the rates of postage thereon, including the determination of the admissibility of publications to the second class of mail matter, their right to continue in that class, and the instruction of postmasters relative thereto; also the use of penalty envelopes, the franking privilege, and the limit of weight and size of mail matter.

Postal Savings.—The conduct and management of the administrative office of the postal savings system at Washington; the selection and designation of post offices as postal savings depository offices and the supervision of the business transacted at such offices; the management and investment of postal savings funds as the agent of the board of trustees; and the administrative examination of accounts of postmasters and other fiscal agents of the system.

FOURTH ASSISTANT POSTMASTER GENERAL

This bureau embraces the Division of Rural Mails, with horse-drawn and motor vehicle service, and the star route service, the Division of Equipment and Supplies, and Village Delivery. All requests for rural service, star route service or extensions of service, the appointment and discipline of rural carriers, and the preparation of all advertisements inviting proposals for star routes, and making awards and contracts, making rural delivery maps and distributing parcel post maps and guides, and all supplies which postmasters need in the conduct of postal business, including office appliances of every description, and all correspondence relating thereto, belong to the duties of this office.

The manufacturing enterprises of the Post Office Department, consisting of the mail bag repair shop and the lock shop, are also under the direction of the Fourth Assistant. All repairs, and the manufacture of new sacks and pouches when necessity requires, the manufacture of all locks and repair of same, and all mechanical devices used in the Railway Mail Service and post offices, which can be furnished from the lock shop, as well as new mechanical designs and improvements for the service, are included. The experimental and research work connected with such manufacturing enterprises, made necessary to meet new and changing conditions, determining the needs of the service as to style and character of equipment, and assure economy in expenditures, is directly under the personal supervision and control of the head of this bureau.

CHAPTER X.

DEPARTMENT OF THE NAVY*

SECRETARY OF THE NAVY

THE Secretary of the Navy performs such duties as the President of the United States, who is Commander in Chief, may assign him, and has the general superintendence of construction, manning, armament, equipment, and employment of vessels of war.

ASSISTANT SECRETARY OF THE NAVY

The Assistant Secretary of the Navy performs such duties as may be prescribed by the Secretary of the Navy or required by law.

CHIEF CLERK

The chief clerk has general charge of the records and correspondence of the Secretary's office, and performs such other duties as may be assigned to him by the Secretary of the Navy.

OFFICE OF NAVAL OPERATIONS

The Office of Naval Operations was established by Act of Congress of March 3, 1915. That act provided that the Chief of Naval Operations should be selected from an officer of the line of the Navy not below the rank of captain and that while holding this position he should have the rank, title and emoluments of a rear admiral. The act of August 29, 1916, provides that while so serving the Chief of Naval Operations shall have the rank and title of admiral, to take rank next after the admiral of the Navy and shall receive the pay of $10,000 per annum and no allowances. He is appointed for a period of four years.

The Chief of Naval Operations is charged, under the direction of the Secretary of the Navy, with the operations of the fleet and with the preparation and readiness of plans for its use in war. This includes the direction of the Naval War College, the Office of Naval Intelligence, inspections, gunnery exercises and engineering performances, the operation of the radio service and of other systems of communication, the operations of the aeronautic service, of mines and mining, of the naval districts, Naval Militia, and of the Coast Guard when operating with the Navy; the direction of all strategic and tactical matters, organization, maneuvers, target practice, drills and exercises, and of the training of the fleet for war; and the preparation, revision and enforcement of all tactics, drill books, signal codes and cipher codes. The orders issued by the Chief of Naval Operations in the performance of his duties are considered as emanating from the Secretary of the Navy and have full force and effect as such.

*There is a special chapter on "The New Navy," page 281.

The Chief of Naval Operations from time to time witnesses the operations of the fleet as an observer.

He has two principal senior assistants, officers not below the grade of captain, one as assistant for operations and the other as assistant for material.

He is *ex-officio* a member of the General Board.

COMMUNICATIONS OFFICE

The Communications Office under the direction of the Chief of Naval Operations handles all the dispatch work of the Navy Department (radio, telegraph, cable, and telephone). A commissioned officer is on watch in the Communications Office at all times, night and day, and is responsible for the routing, coding, and decoding of all dispatches. He is responsible for the proper delivery of all received official dispatches.

The Assistant Communications Officer on watch keeps himself informed of the general and special situations in order that he may thoroughly understand the bearing of dispatches received outside of departmental hours, and he is responsible that dispatches of importance requiring immediate action are communicated as soon as possible to the proper officer.

The Arlington Radio Station is operated from this office.

OFFICE OF NAVAL INTELLIGENCE

The Office of Naval Intelligence is charged with the collection and dissemination of such technical information at home and abroad as will be useful to the Chief of Naval Operations and to the various bureaus of the Navy Department in the formulation of plans for war and in the development of personnel and *matériel.*

OFFICE OF GUNNERY EXERCISES AND ENGINEERING PERFORMANCES

The Office of Gunnery Exercises and Engineering performances is charged with the duties, under the Chief of Naval Operations, of formulating the rules for all forms of gunnery exercises and steaming performances; computing, compiling, and publishing in confidential form the results and records of these competitions; the award of prizes, trophies, and commendatory letters in connection therewith, these competitions being the means to the end; i. e., battle efficiency.

NAVAL COMMUNICATION SERVICE

The Office of Director of Naval Communications is established under the Chief of Naval Operations. The Director of Naval Communications is charged with matters pertaining to the operation of naval radio stations ashore, and in addition is charged with the duties in connection with and is responsible for the efficient handling of all telegraph, telephone and cable and generally all dispatch work between the Navy Department and the fleet, and throughout the naval service outside the fleet. In his administration of the foregoing he has general charge of the operation, organization, and administration of the Communication Service. He co-operates with officials designated by the Secretary of Commerce in reference to location of proposed commercial stations, the licensing of operators, the control of the operation of commercial stations under the law, and the assignment of wave lengths for use by commercial stations which will comply with the law and thereby prevent possible interference with the organization and operation of the Naval Communication Service.

DIVISION OF NAVAL MILITIA AFFAIRS

Since the passage of the Naval Militia Act of February 16, 1914, the activities of the Naval Militia insofar as they concern the Federal Government have come under the Navy Department. All duties in connection with the instruction and training of the Naval Militia and of vessels loaned for their use are under the control of the Chief of Naval Operations. This part of the activities of the office of the Chief of Operations is directly in the hands of the Division of Naval Militia Affairs. This division is, in effect, a complete Navy Department for the Naval Militia insofar as the Federal Government is concerned. The Naval Militia Act of February 16, 1914, provided that the Secretary of the Navy is authorized to so organize, arm, uniform, equip, and train the Naval Militia that it may be eligible to be called forth by the President of the United States to serve the United States in the event of war, actual or threatened, with any foreign nation. In consequence of this act the Secretary of the Navy has defined the units, the number and rank of officers, and the number and rates of petty officers and enlisted men of all Naval Militia organizations. The Division of Naval Militia Affairs has laid down a standard of professional and physical examinations for all grades and ranks in the Naval Militia in order that such officers and men may be mustered into service without further appointment, enlistment or examination.

The division also has control of regulations and contracts under which vessels of the Navy are loaned to the Naval Militia for their training and instruction. Officers are appointed to make annual inspections of Naval Militia organization. Rules and regulations covering the details of training have also been laid down by the division to cover instruction for the Naval Militia given by inspector-instructors, officers of the regular Navy detailed for this specific duty. The division also conducts cruises for instruction of the Naval Militia on vessels of the regular Navy, vessels loaned to the State, aeronautic encampments and Marine Corps encampments. All matters pertaining to the Naval Militia under existing laws and regulations come within the jurisdiction of the Division of Naval Militia Affairs. The records of officers and men, cruises and all like duties of the Naval Militia are kept in the D. N. M. A. In the event of the mustering into the Federal service of the Naval Militia for active duty the division from its records of officers and men would recommend the detail of such officers and men and their orders would be based on such recommendations.

BUREAU OF NAVIGATION

The duties of the Bureau of Navigation comprise the issue, record and enforcement of the orders of the secretary to the individual officers of the Navy; the training and education of line officers and of enlisted men (except of the Hospital Corps) at schools and stations and in vessels maintained for that purpose; the upkeep and operation of the Naval Academy, of technical schools for line officers, of the apprentice-seamen establishments, of schools for the technical education of enlisted men, and of the naval home at Philadelphia, Pa.; the upkeep and the payment of the operating expenses of the Naval War College; the enlistment, assignment to duty, and discharge of enlisted persons.

(2) It has under its direction all rendezvous and receiving ships, and provides transportation for all enlisted persons under its cognizance.

(3) It establishes the complements of all ships in commission.

(4) It keeps the records of service of all officers and men, and prepares

an annual Navy Register for publication, embodying therein data as to fleets, squadrons, and ships, which shall be furnished by the Chief of Naval Operations. To the end that it may be able to carry out the provisions of this paragraph, all communications to or from ships in commission relating to the personnel of such ships are forwarded through this bureau, whatever their origin may be.

(5) It is charged with all matters pertaining to applications for appointments and commissions in the Navy, and with the preparation of such appointments and commissions for signature.

(6) It is charged with the preparation, revision, and enforcement of all regulations governing uniform, and with the distribution of all orders and regulations of a general or circular character.

(7) Questions of naval discipline, rewards, and punishments are submitted by this bureau for the action of the Secretary of the Navy. The records of all general courts-martial and courts of inquiry involving the personnel of the Navy before final action are referred to this bureau for comment as to disciplinary features.

(8) It receives and brings to the attention of the Secretary of the Navy all applications from officers for duty or leave.

(9) It receives all reports of service performed by individual officers or men.

(10) It is charged with the enforcement of regulations and instructions regarding naval ceremonies and naval etiquette.

(11) It shall be charged with the upkeep and operation of the Hydrographic Office, the Naval Observatory, Nautical Almanac, and Compass offices; with all that relates to the supply of ships with navigational outfits, including instruments, and with the maintenance and repair of the same; with the collection of foreign surveys, and with the publication and supply of charts, sailing directions, and nautical works, and the dissemination of nautical, hydrographic, and meteorological information to the Navy and mercantile marine. It shall also have charge of all ocean and lake surveys, and ships' and crews' libraries; it shall defray the expenses of pilotage of all ships in commission.

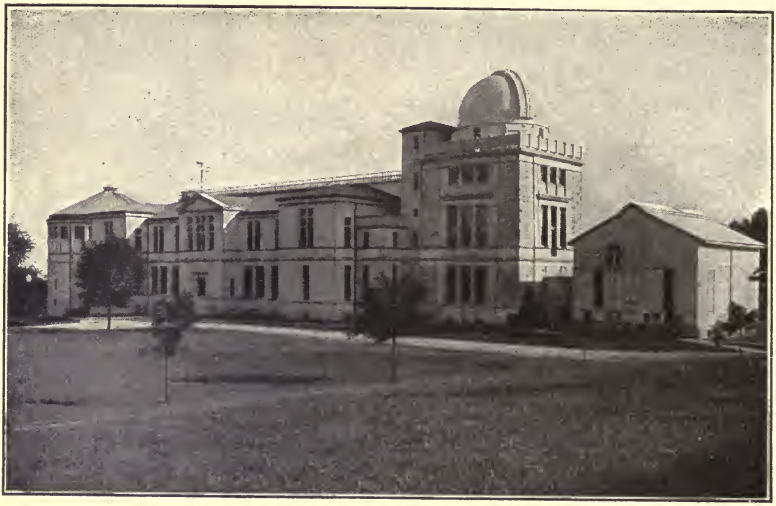
(12) It shall be charged with the formation of the Naval Reserve and with all matters relating thereto.

UNITED STATES NAVAL OBSERVATORY
Including the Nautical Almanac Office

DOME OF OBSERVATORY
Naval Observatory, Washington, D. C.

The Naval Observatory furnishes the United States east of the Rocky Mountains with the standard time at noon, seventy-fifth meridian time, each day, both by telegraph and radio, while the chronometer and time station at the Navy Yard, Mare Island, California, does the same for the country west of the Rockies.

Through the Navy Radio Station the Observatory furnishes vessels navigating the north Atlantic Ocean and the Gulf of Mexico the standard time twice each day, at noon and 10 P. M., and these radio time signals are becoming increasingly used,



THE MAIN BUILDING OF THE NAVAL OBSERVATORY, WASHINGTON, D. C.

by persons having receiving wireless sets throughout the country, in preference to the telegraphic signals.

Navigators, surveyors and astronomers are kept supplied with the positions of the heavenly bodies in a form for practical use through the American Ephemeris and Nautical

TRANSMITTING CLOCKS, CHRONOGRAPHS AND SWITCHBOARDS USED IN THE U. S. NAVAL OBSERVATORY IN SENDING OUT THE TIME TO THE COUNTRY

Almanac, and the American Nautical Almanac through the Nautical Almanac Office, which is a department of the Naval Observatory.

In order to assist in furnishing data to keep the Almanac and Ephemeris up to the highest attainable standard of accuracy continuous fundamental observations of the heavenly bodies are kept up at the Observatory.

When a mariner, a surveyor or an astronomer wishes to find his astronomical position on the globe he does it by observations of the heavenly bodies, using the Nautical Almanac and a comparison of his local time with that of the Observatory.

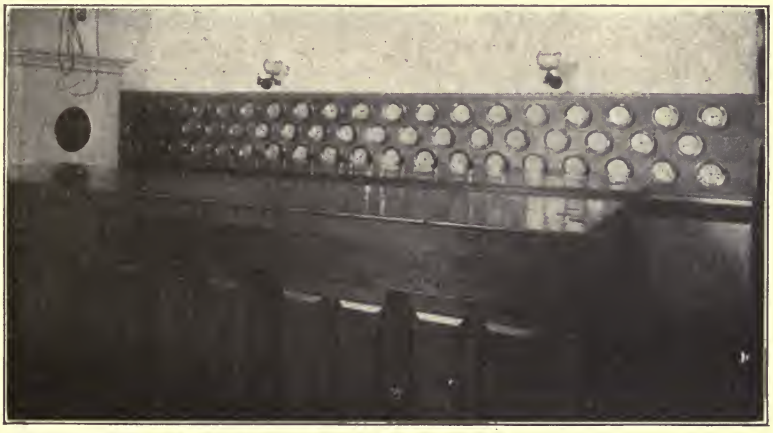
The Naval Observatory also supervises the supplying of the vessels of the Navy and the Naval Air Service with all the instruments used for navigating them, which are numerous and interesting.

THE BUREAU OF YARDS AND DOCKS

The duties of the Bureau of Yards and Docks comprise all that relate to the design and construction of public works of the Navy, such as dry docks, marine railways, building ways, harbor works, quay walls, piers, wharves, slips, dredging, landings, floating and stationary cranes, power plants, coaling plants, heating, lighting, telephone, water, sewer and railroad systems; roads, walks and grounds; bridges, radio towers, hospitals and all buildings for whatever purpose needed, under the Navy and Marine Corps. It has charge of all means of transportation, such as derricks, shears, locomotives, locomotive cranes, cars, motor trucks, and all vehicles, horses, teams, subsistence, and necessary operators and teamsters in the navy yards. It provides clerks for the office of the commandant, the captain of the yard, and public works officer.

In general the work of the bureau is carried out by commissioned officers of the Corps of Civil Engineers, United States Navy, whose major duties comprise the construction, repair and maintenance of the public works and utilities of the Navy.

During the comparatively recent upbuilding of shore establishments of the Navy, large masonry dry docks have been completed at the navy yards, New York, Norfolk, Philadelphia and Charleston on the



COMPARING DECK CLOCKS FOR WAR VESSELS

east coast, and at Mare Island and Puget Sound on the west coast. In addition a 1,000-foot dry dock is now under construction at the Naval Station, Pearl Harbor, Hawaii. This dock when completed is estimated to cost approximately $4,986,500. To provide an entrance channel from the sea to the site of the dock and the naval station, extensive dredging operations were necessary, over $3,000,000 having been expended for this purpose under a single contract. During the last ten years there have been expended under the cognizance of this bureau approximately $70,500,000.

The bureau is justly proud of its record in connection with the construction and operation of the central power plants at the various navy yards, these central plants having been provided for by act of Congress in 1904, in order to avoid the great waste in connection with the operation of many separate plants at each yard. Fourteen such central power plants have been constructed and equipped with the most modern apparatus. To give an idea as to their magnitude it may be stated that these plants produced during the fiscal year 1915 a total of approximately 50,000,000 kilowatt hours of electric power, 6,000,000,000 cubic feet of compressed air, and 3,000,000,000 pounds of steam.

The rapid increase in the use of fuel oil as a source of power for ships has led to the construction of extensive fuel oil storage plants, some seven plants having been completed, with many others contemplated. The present capacity of these plants is approximately 30,000,000 gallons of oil, which will probably be increased to 150,000,000 gallons. These plants are equipped with powerful pumps capable of delivering heavy oils from tanks to ships at the high rate of 1,000 gallons per minute. The tanks are equipped with automatically controlled fire systems, which provide in case of fire a blanket of inert gas in the form of foam over the surface of the oil.

The bureau has had charge of the design and construction of radio towers and other public works connected with the development of the high power radio stations of the Navy. The location of these stations is shown on the Military-Naval Map. The first of these stations to be completed was that at Arlington, Virginia. Others have followed at Colon and Balboa on the Isthmus; Chicago, Illinois; Chelsea, Massachusetts; Washington, D. C.; Key West, Florida; New Orleans, Louisiana; Point Isabel, Texas; Guantanamo, Cuba; Cordova, Alaska; Keyport, Washington; San Diego, California; Pearl Harbor, Hawaii; Island of Guam; Cavite, P. I. The stations in Hawaii have been in telephonic communication by wireless with the radio station at Arlington, Virginia.

This bureau has designed and constructed practically all of the important graving docks in the United States. Most of these docks have been built by and for the Navy. It has, by arrangements made between the Commonwealth of Massachusetts and the Navy Department, designed and is supervising the construction of the State Graving Docks in Boston. It will also give general supervision to the graving dock to be constructed by the Union Iron Works in San Francisco, California.

A member of the Corps of Civil Engineers of the Navy has been connected with the construction of the Panama Canal as Commissioner and also Engineer of Terminal Construction. This bureau has been represented by one of its officers on the International Board of Consulting Engineers.

BUREAU OF ORDNANCE

The Bureau of Ordnance of the Navy Department is charged with the design and manufacture of all guns, gun carriages, ammunition,

mines, torpedoes, and explosives used by the Navy Department. It has under its cognizance the Gun Factory at Washington, D. C., the Naval Proving Ground at Indian Head, Md., and the Torpedo Station at Newport, R. I., besides all of the magazines and ammunition depots pertaining to the Navy.

The duties of the Bureau of Ordnance comprise all that relates to the upkeep, repair and operation of the torpedo station, naval proving ground, and magazines on shore, to the manufacture of offensive and defensive arms and apparatus (including torpedoes and armor), all ammunition and war explosives. It requires for or manufactures all machinery, apparatus, equipment, material and supplies required by or for use with the above.

It determines the interior dimensions of revolving turrets and their requirements as regards rotation.

As the work proceeds it inspects the installation of the permanent fixtures of the armament and its accessories on board ship, and the method of stowing, handling, and transporting ammunition and torpedoes, all of which work must be performed to its satisfaction. It designs and constructs all turret ammunition hoists, determines the requirements of all ammunition hoists and the method of construction of armories and ammunition rooms on shipboard, and, in conjunction with the Bureau of Construction and Repair, determines upon their location and that of all ammunition hoists outside of turrets. It installs all parts of the armament and its accessories which are not permanently attached to any portion of the structure of the hull, excepting turret guns, turret mounts, and ammunition hoists, and such other mounts as require simultaneous structural work in connection with installation or removal. It confers with the Bureau of Construction and Repair respecting the arrangements for centering the turrets and the character of the roller paths and their supports.

It has cognizance of all electrically operated ammunition hoists, rammers and gun-elevating gear which are in turrets; of electric training and elevating gear for gun mounts not in turrets; of electrically operated air compressors for charging torpedoes; and of all range finders and battle order and range transmitters and indicators.

BUREAU OF CONSTRUCTION AND REPAIR

The head of this Bureau is the Chief Constructor, who is an officer of the Construction Corps of the Navy and is appointed by the President and confirmed by the Senate for a four-year term. By the authority of statute law orders issued by him in regard to the work of this bureau have the same force and effect as though issued by the Secretary of the Navy.

The Chief Constructor is responsible for the general designs of all vessels of the Navy and for incorporating therein the military characteristics approved by the Secretary of the Navy and for making the necessary provision in the design and in the completed ship for the propelling machinery, ordnance and other items under the cognizance of other bureaus of the Navy Department. He is responsible for the detail design and construction of ships' hulls, their strength and stability, hull auxiliaries, fittings and equipage. In connection with the same parts he is charged with their inspection in ships building by private contract, with their construction in ships building in navy yards, with their repair in ships in commission, with their maintenance and preservation in ships out of commission, and with the preparation of specifications for and the inspection of all material necessary for these various purposes.

In the execution of these duties he is responsible for the proper expenditure of all appropriations made by Congress for these purposes.

BUREAU OF STEAM ENGINEERING

The Bureau of Steam Engineering is charged with the responsibility for the design, the construction, and the maintenance in good condition of the propelling machinery of vessels of the Navy; of their electric light and power equipment, except of motors installed by other bureaus; of radio stations and their equipment on shore and of the radio equipment afloat; of heating and refrigerating apparatus; of distilling apparatus; of the interior communication system, comprising telephones, call bells, etc., and of electric signaling apparatus; of aeroplane motors, motors for small boats, and for all steam connections in the ship.

In carrying out this work it has indirect control of the shops of the machinery division in navy yards and has supervision and control of the Engineering Experiment Station at Annapolis, the Aeronautic Motor Laboratory at Washington and of laboratories for other purposes in navy yards, and of the fuel oil testing plant at Philadelphia.

It has cognizance of the entire system of interior communications. It is specifically charged with the design, supply, installation, maintenance, and repair of all means of interior and exterior electric signal communications (except range finders and battle-order and range transmitters and indicators), and of all electrical appliances of whatsoever nature on board naval vessels, except motors and their controlling apparatus used to operate the machinery belonging to other bureaus.

It has charge of the design, manufacture, installation, maintenance, repair, and operation of wireless telegraph outfits on board ship and of wireless telegraph outfits and stations on shore. (See "Radio Service," p. 528.)

It has charge of the design, manufacture, installation, maintenance, repair, and operation of aeroplane motors and propellers and their attachments.

It has supervision and control of the Engineering Experiment Station.

It designs the various shops at navy yards and stations where its own work is executed, so far as their internal arrangements are concerned.

BUREAU OF MEDICINE AND SURGERY

The Medical Department of the Navy has charge of the well-being in health and disease of the personnel of the Navy and Marine Corps, numbering now over 100,000. Not only is sickness cared for, hospital or sick-bay treatment provided, necessary operative measures undertaken, but also those in sound health are safeguarded in life and limb as far as modern science can avail.

To this end Surgeon General W. C. Braisted has under him a Medical Corps authorized up to a total of over 600, a Dental Corps, a Nurse Corps, and a Hospital Corps of an authorized strength of over 3,000. In addition he has available for call Medical and Dental Reserve Corps composed of physicians and dentists in civil life who have patriotically offered their services in case of national emergency.

These forces are directed by the Surgeon General, as head of the Bureau of Medicine and Surgery. He has charge of the upkeep and operation of all naval hospitals, numbering at present eighteen, situated not only within the continental limits of the United States, but also in our insular possessions. He has under consideration all questions concerning the health, the hygiene, and sanitation of the service, ashore and

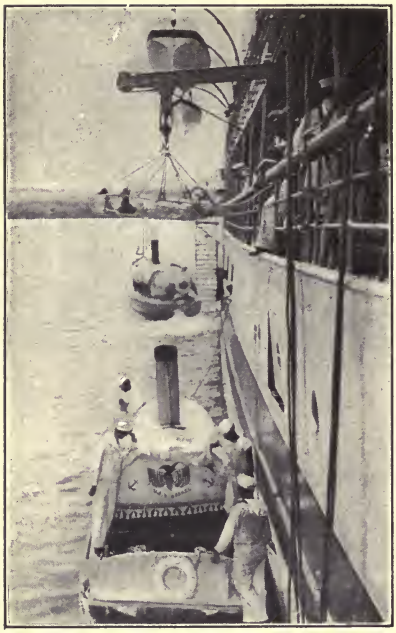
U. S. NAVAL MEDICAL SCHOOL, WASHINGTON, D. C.

afloat. One or more medical officers are carried on all ships operating singly, and on flagships of destroyer and submarine flotillas.

The Medical Corps in addition undertakes all physical examinations for the service at the many recruiting stations throughout the country, and on board ships and at naval stations and yards. It passes professionally upon all applicants for enlistment or promotion in the Hospital Corps, and educates and supervises the members of this corps during the entire tenure of service. To this end two excellent Hospital Corps Training Schools have been established, one at Newport, R. I., the other at San Francisco, Cal.

The Surgeon General assigns, through the Bureau of Navigation, all of the personnel under his charge to their respective duties, keeping himself constantly in touch with all specially qualified in various professional lines. He also has charge of the upkeep and operations of the three Naval Medical Supply Depots (Brooklyn, Mare Island and Canacao), medical laboratories, dispensaries, and technical schools for the Medical and Hospital Corps. The Naval Medical School, in connection with the Naval Hospital, Washing-

OPERATING ROOM OF THE U. S. HOSPITAL SHIP "SOLACE"



HOISTING A PATIENT ON BOARD THE "SOLACE"

ton, D. C., provides most valuable post-graduate courses, and laboratory facilities for research and investigation.

One of the most valuable assets of the Medical Department is the Hospital Ship "Solace," attached to the Atlantic Fleet, and even more so will be the magnificent new hospital ship authorized by the Sixty-fourth Congress.

In addition to the many above enumerated duties and responsibilities, the Surgeon General requisitions for all supplies, medicines, instruments, etc., used in the Medical Department of the Navy, and he has control of the preparation, reception, storage, care, custody, transfer, and issue of all supplies of every kind used in the Medical Department for its own purposes.

And lastly, the numerous gallant activities on foreign shores which have made the name of the U. S. Marine Corps justly famous, are always attended by their quotas of efficient, self-sacrificing, and heroic members of the Medical and Hospital Corps of the U. S. Navy.

BUREAU OF SUPPLIES AND ACCOUNTS

The duties of the Bureau of Supplies and Accounts comprise all that pertains to the purchase, receipt, care, issue and accounting for all supplies and materials for the Navy, which include provisions, clothing, coal, oil and general supplies; the preparation of standard specifications for all supplies; the shipment thereof, including transportation of coal and fuel oil and the location of the sources of supply.

They also comprise the audit of property returns; audit and payment of vouchers under contract; payment of traveling expenses, gratuity claims and allotments made by officers and enlisted men, and payments to the Naval Reserve; the recording of expenditures of money under the several appropriations and the distribution of costs to the various activities of the Naval establishment. This bureau also administers the Commissary Department of the Navy and is responsible for procuring and issuing all food supplies to the enlisted men; it likewise operates the two naval clothing factories where articles of uniform and clothing are manufactured for the men.

HYDROGRAPHIC OFFICE*

The Hydrographic Office carries on marine surveying in foreign waters; gathers hydrographic and navigational data from mariners, professional publications, Government officials, etc., at home and

*The work of this office is of such importance that a special illustrated chapter dealing in part with this subject will be found on page 129.

abroad; prepares, prints, and issues navigational charts of foreign waters to the Navy and other public services and sells them to the merchant marine and the public; similarly with regard to books of sailing directions for foreign waters and manuals and tables for navigators, except that their printing is done at the Government Printing Office.

OFFICE OF THE JUDGE ADVOCATE GENERAL

The act of March 2, 1865, authorized the President to appoint an officer in the Navy Department to be called "the Solicitor and Naval Judge Advocate General." The appointee pursuant to this act was carried on the Navy Register until 1870 when the Department of Justice was established. The act establishing the Department of Justice (June 22, 1870) provided that "the Solicitor and Naval Judge Advocate General, who shall hereafter be known as the Naval Solicitor," should be transferred to the Department of Justice. The incumbent's name was then dropped from the Navy Register and placed upon the rolls of the Department of Justice. At his death in 1878 he was succeeded by an Acting Judge Advocate General, whose office was in the Navy Department until June 8, 1880, when the office of the Judge Advocate General of the Navy, as a part of the Department of the Navy, was established.

The duties of the Judge Advocate General of the Navy are set forth in detail in the United States Navy Regulations, 1913, as follows:

"The duties of the Judge Advocate General of the Navy shall be to revise and report upon the legal features of and have recorded the proceedings of all courts-martial, courts of inquiry, boards of investigation, inquest, and boards for the examination of officers for retirement and promotion in the naval service; to prepare charges and specifications for courts-martial, and the necessary orders convening courts-martial in cases where such courts are ordered by the Secretary of the Navy; to prepare court-martial orders promulgating the final action of the reviewing authority in court-martial cases; to prepare the necessary orders convening courts of inquiry in cases where such courts are ordered by the Secretary of the Navy, and boards for the examination of officers for promotion and retirement, and for the examination of candidates for appointment as commissioned officers in the Navy other than midshipmen, and to conduct all official correspondence relating to such courts and boards.

"It is also the duty of the Judge Advocate General to examine and report upon all questions relating to rank and precedence, to promotions and retirements, and to the validity of the proceedings in court-martial cases, all matters relating to the supervision and control of naval prisons and prisoners [disciplinary ships and detentioners]; the removal of the mark of desertion; the correction of records of service and reporting thereupon in the Regular or Volunteer Navy; certification of discharge in true name; pardons; bills and resolutions introduced in Congress relating to the personnel and referred to the department for report, and the drafting and interpretation of statutes relating to the personnel; references to the Comptroller of the Treasury with regard to pay and allowances of the personnel; questions involving points of law concerning the personnel; proceedings in the civil courts in all cases concerning the personnel as such; and to conduct the correspondence respecting the foregoing duties, including the preparation for submission to the Attorney General of all questions relating to subjects coming under his own cognizance which the Secretary of the Navy may direct to be so referred."

The study of International Law

has also recently been assigned to the office of the Judge Advocate General, and he is required to examine and report upon questions of international law. Because of the present European conflict and the strained relations between this country and Mexico, many intricate questions of present moment have arisen, such as the interference with American mail, removal of ex-enlisted men of the naval service from American ships, attempts by belligerent ships to board naval auxiliaries, the exercise of visit and search by them in territorial waters, etc.

The subjects of the treatment of prisoners of war, while under the jurisdiction of the Navy Department, and of belligerent ships and individuals interned in this country, and the formulation of regulations to cover same, have also been assigned by regulation to this office.

BOARD OF INSPECTION AND SURVEY

The Board of Inspection and Survey is charged, under specific directions in each case, with conducting preliminary and final acceptance trials of all naval vessels as they come from the works of the builders; with the survey and inspection of all naval vessels in service at least every three years and at such other times as conditions render such inspections necessary or desirable; with the inspections of motorboats for coast defense and patrol purposes. A section of the Board of Inspection and Survey, working with certain Army officers, constitutes a Board for the Inspection of Merchant Auxiliaries. The board operates both directly and through sub-boards.

OFFICE OF THE SOLICITOR

The duties of the Solicitor comprise and relate to examination and report upon questions of law, including the drafting and interpretation of statutes, and matters submitted to the accounting officers not relating to the personnel; preparation of advertisements, proposals, and contracts; insurance; patents; the sufficiency of official, contract, and other bonds and guaranties; proceedings in the civil courts by or against the Government or its officers in cases relating to material and not concerning the personnel as such; claims by or against the Government; questions submitted to the Attorney General, except such as are under the cognizance of the Judge Advocate General; bills and congressional resolutions and inquiries not relating to the personnel and not elsewhere assigned; the searching of titles, purchase, sale, transfer, and other questions affecting lands and buildings pertaining to the Navy; the care and preservation of all muniments of title to land acquired for naval uses; and the correspondence respecting the foregoing duties; and rendering opinion upon any matter or question of law referred to him by the Secretary or Assistant Secretary.

MAJOR GENERAL COMMANDANT OF THE MARINE CORPS

The Major General Commandant of the Marine Corps is responsible to the Secretary of the Navy for the general efficiency and discipline of the corps; makes such distribution of officers and men for duty at the several shore stations as shall appear to him to be most advantageous for the interests of the service; furnishes detachments for vessels of the Navy according to the authorized scale of allowance: issues orders for the movement of officers and troops, and such other orders and instructions for their guidance as may be necessary; and has charge and exercises general supervision and control of the recruiting service of the corps, and of the necessary expenses thereof, including the establishment of recruiting stations.

CHAPTER XI.

DEPARTMENT OF THE INTERIOR

SECRETARY OF THE INTERIOR

THE Secretary of the Interior is charged with the supervision of public business relating to patents for inventions, pensions and bounty lands, the public lands and surveys, the Indians, education, the Geological Survey, the Reclamation Service, the Bureau of Mines, national parks, distribution of appropriations for agricultural and mechanical colleges in the States and Territories and certain hospitals and eleemosynary institutions in the District of Columbia. By authority of the President the Secretary of the Interior has general supervision over the work of completing the survey of routes for railroads in the Territory of Alaska. He also exercises certain other powers and duties in relation to the Territories of the United States.

FIRST ASSISTANT SECRETARY OF THE INTERIOR

In the absence of the Secretary the First Assistant Secretary becomes Acting Secretary. He is especially charged with supervision of the business of the General Land Office, including cases appealed to the Secretary of the Interior from decisions of that bureau involving public lands; applications for easements or rights of way for reservoirs, ditches, railroads, telephone and power-transmission lines; selections of public lands under grants made by Congress to aid in the construction of railroads and wagon roads, for reclamation, and for the benefit of educational and other public institutions, etc. Indian affairs affecting the disposal of the public domain are under his supervision. He considers proposed legislation pertaining to matters under his administration. From time to time duties in connection with the affairs of other bureaus of the department are assigned to him.

ASSISTANT SECRETARY OF THE INTERIOR

The Assistant Secretary has general supervision over all matters concerning the Indian Office (except those which relate to the work of the General Land Office and are forwarded through that office), the Patent Office, the Bureau of Mines, the Pension Office (including appeals from the decisions of the Commissioner of Pensions), the execution of contracts and the approval of vouchers covering expenditures of money for the eleemosynary institutions under the Department of the Interior in the District of Columbia (including Saint Elizabeth's Hospital, formerly the Government Hospital for the Insane), and various miscellaneous matters over which the department has jurisdiction. He also considers proposed legislation pertaining to the department.

ASSISTANT TO THE SECRETARY

This officer is charged with the general supervision of matters relating to the eleemosynary institutions under the Department of the Interior in the District of Columbia, the Bureau of Education, the national parks, national monuments, and the Territories.

CHIEF CLERK

As the chief executive officer of the department and the administrative head of the Office of the Secretary the chief clerk has supervision over the clerks and other employees of the department (including the watch, mechanical and labor forces), enforces the general regulations of the department, and is superintendent of the several buildings occupied by the department. He also supervises the classification and compilation of all estimates of appropriations. The detailed work relating to eleemosynary institutions in the District of Columbia under the Department of the Interior, the office of the returns clerk, and miscellaneous matters is done in his office. During the absence of the Secretary and Assistant Secretaries he may be designated by the Secretary to sign official papers and documents.

COMMISSIONER OF PATENTS

The Commissioner of Patents is charged with the administration of the patent laws, and supervision of all matters relating to the granting of letters patent for inventions, and the registration of trade-marks. He is by statute made the tribunal of last resort in the Patent Office, and has appellate jurisdiction in the trial of interference cases, of the patentability of inventions, and of registration of trade-marks.

THE UNITED STATES PATENT OFFICE, WASHINGTON, D. C.

THE PATENT OFFICE*

The duties of the Patent Office or its functions with respect to the inventor may be classified under a few heads. Each of these is of great importance and it is thought that the simplicity of the classification may aid somewhat in understanding fully just what the Patent Office does for an inventor.

In the first place, it is the keeper of records, maintaining as it does in well classified form the patents issued by the United States, and also the patents issued by numerous foreign nations which issue Letters Patent for inventions. Incidentally, it permits the inspection of these records by inventors or those acting for them and also furnishes certified and uncertified copies of so much of these records as may be desired by the public.

The registration of trade-marks and labels and the granting of patents for designs also come within the duties of the Patent Office, as well as the recordation of assignments and other instruments in writing affecting the title to patents.

It also maintains among its records the pending applications for patents, which are not open to public inspection except to the applicant or those acting by his authority, and forfeited and abandoned applications which, like the pending applications, are not open to public inspection.

INTERIOR VIEW OF THE PATENT OFFICE

The Patent Office also examines patent applications and determines

*There is a special historical chapter on the Patent Office, page 199.

the propriety of issuing patents on the same, this procedure including appeals within the Patent Office from the Primary Examiners to the Board of Examiners-in-Chief, thence to the Commissioner and thence to the Court of Appeals of the District of Columbia, the Commissioner in appeals to the court being represented usually by one of his law examiners.

The Patent Office also includes the court of first resort in interference cases, that is to say, cases wherein two or more inventors are claiming the same patentable subject matter, and it is for the Patent Office to decide whether patent shall issue to the applicant whom it may be determined was first to make the invention. This procedure also contemplates appeals to the Board of Examiners-in-Chief and thence to the Commissioner and to the Court of Appeals.

It is believed that under the foregoing heads all of the functions of the Patent Office can be classified.

The course of a patent application through the Patent Office is ordinarily a simple one. The application, including the petition, specification and oath and drawing and the first Government fee of $15, being deposited with the Financial Clerk, the application papers and drawings find their way to the application room and draftsmen's room, and when the application is found in proper form is forwarded by the chief of the application room to the Primary Examiner in whose class the particular invention is found to belong. The application is then examined in the order of its filing in such Examiner's division, and if it be found in condition for allowance, or when it is so found, it is transmitted to the Issue Division, which issues a circular of allowance. Then if the second Government fee of $20 be paid into the Patent Office within six months from the date of allowance of the application, the patent will in a few weeks issue and be forwarded to the applicant or his attorney. If objections are found to the application either in form or in substance, considerable time is involved in many cases in adjusting these matters to bring the application into condition for allowance or for final rejection.

The Primary Examiner, through one of his assistants, considers the application in the first instance, and if it is found allowable by the Primary Examiner, either in first form or as amended, the case passes to the Issue Division without consideration by those higher in authority. On the other hand, if objections relating to form are found these may be reviewed by petition to the Commissioner direct. If the objections go to the merits, such for instance as a rejection on the ground that the invention is not new in view of any particular reference cited, appeal may be taken to the Board of Examiners-in-Chief. A petition relating to form involves no Government fee, while a petition affecting the merits and going to the Board of Examiners-in-Chief calls for a Government fee of $10. Such is the course of a patent application when actually filed.

To aid inventors and their attorneys in determining the probable novelty of any particular invention, the Patent Office maintains a Search Room containing the U. S. patents classified according to the official practice and arranged in suitable stacks or racks so that if the invention be, for instance, a Nut Lock, the searcher may secure the bundle containing patents for such devices, or if it be a dynamo or a telephone, he can secure the bundle having the particular character of such devices to which the invention he is searching relates.

The Patent Office is not a bureau of information and does not undertake to answer miscellaneous inquiries relative to patents, nor to express any opinion in advance of the filing of a formal application for patent as to the patentability of any particular invention.

COMMISSIONER OF PENSIONS

The Pension Bureau, which is said to be the largest bureau in the Government service, and the only bureau which occupies a building erected for its especial use, is the active agency through which there was paid out last year one hundred and sixty millions of dollars of pensions to more than seven hundred thousand pensioners.

At times some magazine article complains of the amount of pensions, but it will be noticed by those who have knowledge of the recent allowances in Canada, Australia and Great Britain, that the amount paid to an individual here is less than that now paid in other countries. The modern tendency is to care more for the private soldier. This is justified by two viewpoints—one is that he is the most valuable component part of an army and should be kept efficient and encouraged both by good care of him and of his family. The other reason is humanity, which now pays more regard to the humbler member as a unit of society.

There are now on the pension roll about four hundred thousand males and three hundred thousand widows. Death is making sad havoc among their numbers. Last year there died, of Civil War soldiers, 34,252; and of widows, 19,957.

THE PENSION OFFICE

Besides the Commissioner, there are 1,200 employees transacting the necessary business of the Pension Bureau. Applications are not so numerous as formerly, yet there were more than sixty-five thousand received during last year, and 68,549 new certificates were issued. The total cost of administration was only 1 per cent of the pensions paid out, which is lower than ever before. It is believed that, under the present administration, the pension laws have been faithfully executed in an efficient and economic manner. Every beneficiary has been given that to which the law entitled him.

An additional pension of $10 per month has been allowed to soldiers and sailors holding medals of honor.

The Act of September 8, 1916, increases from $12 to $20 per month

the widows of Mexican and Civil War soldiers who are seventy years of age, or who were married to the soldier during the period of his service. That act also makes pensionable widows of Civil War soldiers who married prior to June 27, 1905, and certain remarried widows.

Formerly payment to the pensioner was delayed, but now the check is delivered to him on the exact date when due. Recently methods have been much simplified. The expense of executing vouchers has been eliminated—a saving to the soldiers themselves of many thousands of dollars—and they are no longer required to exhibit their certificates each time of indorsement of the check.

COMMISSIONER OF INDIAN AFFAIRS

The Commissioner of Indian Affairs has charge of the Indian tribes of the United States (exclusive of Alaska), their education, lands, moneys, schools, purchase of supplies, and general welfare.

COMMISSIONER OF EDUCATION

The Commissioner of Education collects statistics and general information showing the condition and progress of education, issues an annual report, a bulletin in several numbers annually, and miscellaneous publications; has charge of the schools for the education of native children in Alaska; supervises the reindeer industry in Alaska, and administers the endowment fund for the support of colleges for the benefit of agriculture and mechanic arts. See page 255.

UNITED STATES RECLAMATION SERVICE*

UNITED STATES GEOLOGICAL SURVEY*

GENERAL LAND OFFICE

The General Land Office is the oldest and in many respects the largest and most important Bureau of the Department of the Interior; it has jurisdiction over all matters pertaining to the survey and disposition of the public lands of the United States, exclusive of lands in the insular possessions; also, in point of number of cases and values involved, the General Land Office, in the determination of questions with respect to title to public lands, exercises judicial functions of vast importance. Its internal organization consists of the Washington office, the local United States land offices, the offices of Surveyors General, the field surveying organization and the field service organization, making a total of about one hundred and twenty-five branch offices and headquarters, principally in the Western States. This bureau employs altogether about sixteen hundred people. Contrary to popular belief the business of this department has not decreased in recent years, and, owing to new legislation and change of governmental policies, its work is increasingly complicated and exacting.

NATIONAL BUREAU OF MINES

The National Bureau of Mines, under the Department of the Interior, was created by act of Congress, approved May 16 and effective July 1, 1910. This act was amended by an act, effective February 25, 1913, which provides that the Bureau of Mines is to be a

*The work of the United States Reclamation Service and of the United States Geological Survey is of such importance that special chapters on these subjects are given in the first part of the book. See pages 87 and 119.

bureau of mining, metallurgy and mineral technology, and that the duty of the bureau shall be to conduct scientific and technologic investigations concerning mining, and the preparation, treatment and utilization of mineral substances with a view to improving health conditions and increasing safety, efficiency and economic development, and conserving resources through the prevention of waste in the mining, quarrying, metallurgical and other mineral industries; to inquire into the economic conditions affecting these industries; to investigate explosives and peat; and on behalf of the Government to investigate the mineral fuels and unfinished mineral products belonging to, or for the use of, the United States, with a view to their most efficient mining, preparation, treatment and use; and to disseminate information concerning these subjects. The act further provides that no member of the bureau shall have any personal or private interest in any mine or the products of any mine under investigation, or shall accept employment from any private party for services in the examination of any mine or private mineral property, or issue any report as to the valuation or the management of any mine or other private mineral property. This provision, however, does not apply to the temporary employment in a consulting capacity of experts whose principal practice is outside of the bureau. Another section of the act directs that a reasonable fee covering necessary expenses shall be charged by the bureau in making tests other than those for the Government of the United States or State governments.

The inquiries and investigations being carried on by the bureau under the provisions of this act cover a wide variety of subjects and are too numerous to mention here. The chief experiment station of the bureau is in Pittsburgh, Pa. Work relating to the causes and prevention of mine explosions, to which the bureau has given special attention, and other mining problems, includes laboratory tests, the examination of mines and experiments in an experimental mine near Pittsburgh under conditions simulating those of commercial operations.

In order to carry on investigations and educational work for greater safety in mining, the Bureau of Mines has six mine-rescue stations situated in different mining regions of the country, and also operates eight mine-rescue cars and two rescue trucks. These cars and trucks, manned by trained crews, are constantly ready to give aid, when requested by State officials, at a mine disaster. The cars move from point to point in the regions in which they are stationed, and the crews demonstrate safe methods of mining and the use of rescue apparatus and first-aid appliances.

An act of Congress, approved March 3, 1915, authorizes the establishment and maintenance under the Bureau of Mines of ten mining experiment and seven mine safety stations (mine rescue cars), in addition to those already established, not more than three of each class of stations to be established in any one year. It is expected that through these stations the safety work of the bureau will be made more effective, and that the investigations for increasing efficiency in the handling and utilization of mineral resources will be enlarged and extended.

How Five People Can Live on $8.03 a Week
Actual Supply for a Week of Meat, Groceries, Bread, Etc.
Figures supplied by Dep't of Health, New York, Nov. 17, 1916
THE BALANCED RATION

CHAPTER XII.

DEPARTMENT OF AGRICULTURE*

SECRETARY OF AGRICULTURE

THE Secretary of Agriculture is charged with the work of promoting agriculture in its broadest sense. He exercises general supervision and control over the affairs of the department and formulates and establishes the general policies to be pursued.

ASSISTANT SECRETARY OF AGRICULTURE

The Assistant Secretary of Agriculture becomes Acting Secretary in the absence of the Secretary and assists in the general supervision of the work of the department at all times.

CHIEF CLERK

The chief clerk has general supervision of clerks and employees; of the records and correspondence of the Secretary's office; and of expenditures from appropriations for miscellaneous expenses, rent of buildings, etc. He is responsible for the enforcement of the general regulations of the department and is custodian of the buildings occupied by the department in the city of Washington.

SOLICITOR

The solicitor is charged by law (act of May 26, 1910) with the direction of the legal work of the department. Accordingly, he acts as legal adviser to the Secretary and the heads of the several branches of the department, conducts its legal work, and represents it in all legal matters. He approves, in advance of issue, all orders and regulations promulgated by the Secretary under statutory authority.

OFFICE OF FARM MANAGEMENT

This office studies the details of farm practice. Its main object is to improve farm practice by introducing better business methods and by applying the principles of science wherever they are known. The types of farming prevailing in the various sections of the country are being studied in a number of localities, and a detailed study of farm economics and business principles is being made.

*There is a special chapter on "Agriculture," page 37.

APPOINTMENT CLERK

The appointment clerk prepares all papers connected with appointments, transfers, promotions, reductions, details, furloughs, and removals, and has charge of correspondence with the Civil Service Commission. He is the custodian of oaths of office and personal reports. He has the custody and use of the department seal.

SUPPLY DIVISION

The chief of the supply division purchases and distributes stationery and miscellaneous supplies and disposes of property turned in by the various offices when it is of no further use to them.

OFFICE OF EXHIBITS

The office of exhibits handles the correspondence of the department relative to exhibits at fairs and expositions of various kinds; co-operates with the several branches of the department in preparing exposition material; ships, installs, and cares for such exhibits; and investigates methods of displaying them to best advantage.

OFFICE OF INFORMATION

The office of information is established to secure the widest possible circulation for the discoveries and recommendations of the scientists and field workers of the department. It gives out to the public press facts taken from publications and also from oral statements of specialists. Material so disseminated is set forth in such form as to attract attention and lead to the adoption of the methods recommended. A Weekly News Letter to Crop Correspondents is published.

FOREST APPEALS

This officer investigates for the Secretary of Agriculture appeals from decisions of the Forest Service and reports to the Secretary.

UNITED STATES WEATHER BUREAU

By C. F. MARVIN
CHIEF U. S. WEATHER BUREAU

THE history of the Weather Bureau as an organization begins with the passage of the act of Congress, approved February 9, 1870, which authorized and required the Secretary of War to provide for the taking of meteorological observations throughout the United States and for giving telegraphic notice on the lakes and seacoast of the approach of storms. Since its establishment the scope of its work has been gradually extended until now its functions as defined by law embrace the forecasting of the weather; the issue of storm warnings; the display of weather, frost and flood signals for the benefit of agriculture, commerce and navigation; the gaging and reporting of rivers; the maintenance and operation of seacoast telegraph lines and the collection and transmission of marine intelligence for the benefit of commerce and navigation; the reporting of temperature and rainfall conditions for the cotton interests, and the taking of such meteorological observations as may be necessary to establish and record the climatic conditions of the United States, or are essential for the prop-

er execution of the foregoing duties. From the date of its organization until July 1, 1891, the weather service was conducted as a branch of the Signal Corps, under the direction of the Chief Signal Officer of the Army, but on the date mentioned it was transferred to the Departments of Agriculture and made a bureau of that Department, under its present designation.

The Weather Bureau is probably best known to the general public through the exercise of its principal and most important function, the issue of the daily weather forecasts. These forecasts are based upon simultaneous observations of local weather conditions taken daily at 8 A. M. and 8 P. M., 75th meridian time, at about two hundred regular observing stations scattered throughout the United States and the West Indies, and upon similar reports received daily from various points in other parts of the northern hemisphere. The results of the twice-daily observations are immediately telegraphed to the Central Office at Washington, D. C., where they are charted for study and interpretation by experts trained to forecast weather conditions which may be expected to prevail during the following thirty-six to forty-eight hours. From these data the forecaster, by comparison with preceding reports, is able to trace the paths of storm areas from the time of their appearance to the moment of observation, and approximately determine and forecast their subsequent courses and the resultant weather conditions.

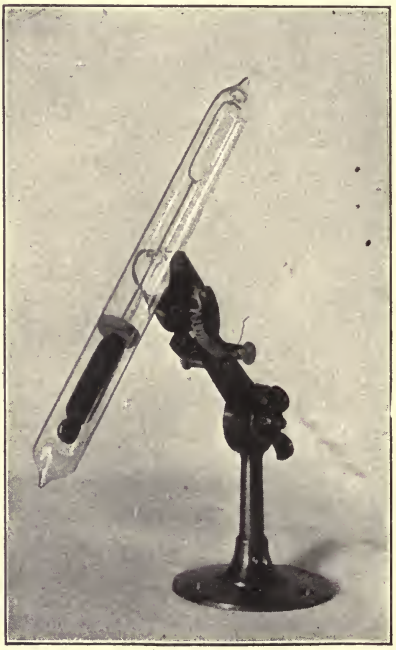
CENTRAL OFFICE OF THE U. S. WEATHER BUREAU, WASHINGTON, D. C.

Forecast centers have also been established at Chicago, Ill.; New Orleans, La.; Denver, Colo.; San Francisco, Cal.; and Portland, Ore. Within two hours after the morning observations have been taken the forecasts are telegraphed from the forecast centers to about 1,700 principal distributing points, whence

they are further disseminated by telegraph, telephone and mail. The forecasts reach nearly 100,000 addresses daily by mail, the greater part being delivered early in the day, and none later, as a rule, than 6 P. M. of the day of issue, and are available to more than 5,000,000 telephone subscribers within an hour of the time of issue. This system of forecast distribution is wholly under the supervision and mainly at the expense of the Government, and is in addition to and distinct from the distribution effected through the press associations and the daily newspapers. The rural free mail delivery system and rural telephone lines are also being utilized to bring within the benefits of this system a large number of farming communities. A careful comparison of the forecasts with the weather conditions occurring over the regions and during the periods covered shows that approximately ninety per cent of the forecasts are verified.

The daily weather maps, based on the data contained in the morning telegraphic reports, are issued as soon as practicable after these reports are received. On these maps the salient features of the current weather conditions throughout the country are graphically represented, accompanied by a synopsis of these conditions; in addition to which complete reports from all the observing stations are presented in tabulated form. In order that all sections of the country may receive weather data, maps or bulletins containing the data in tabulated form, are issued from about one hundred of the larger stations.

The ocean meteorological service aims to collect, through the co-operation of vessel masters and others, meteorological observations at sea. The recent development in the art of radio-telegraphy has made possible the transmission of meteorological observations made by ships at sea to shore stations, thence by land lines to a central meteorological service. The Weather Bureau has organized a system of meteorological observations on vessels navigating the coastal waters of the middle and South Atlantic States, the Gulf of Mexico, and the Caribbean Sea, the primary object being to gain information of sub-tropical storms which occasionally traverse the waters above named. Distribution of weather information, forecasts, and warnings is made daily by radio service through the co-operation of the radio service of the United States Navy.



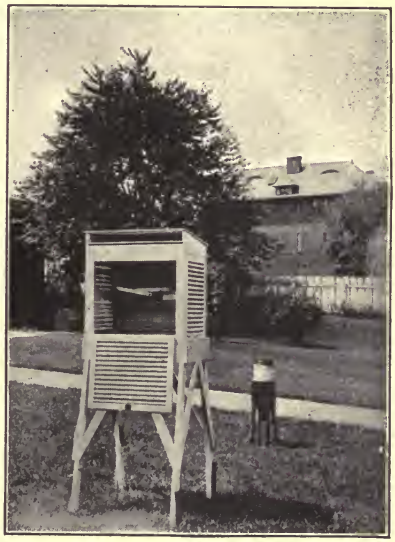
MARVIN ELECTRICAL SUNSHINE RECORDER

Although the two hundred regular observing stations, each representing about 16,000 square miles of territory, furnish sufficient data upon which to base the various forecasts, observations at many intermediate points are necessary before

the climatology of the United States can be properly studied. This need has given rise to the establishment of an important and interesting feature of the Weather Bureau in its Climatological Service. This service is divided into forty-four local sections, each, as a rule, covering a single State, and having for its center a regular observing station. These centers collect temperature and rainfall observations from more than 4,000 co-operative stations and publish these data in the form of monthly reports which are given a widespread distribution. During the growing season (from April to September, inclusive) each section also receives mail reports from numerous correspondents (aggregating for all sections about 7,500) concerning the effects of the weather upon crops and farming operations, these reports being used to compile data for weekly bulletins. During the same season the Central Office at Washington issues a National Weather and Crop Bulletin containing a series of charts graphically illustrating current and normal conditions of temperature and rainfall for the entire country, a general summary of the weather, and brief reports on the condition of the crops for each State. Throughout the cotton, corn, wheat, sugar and rice producing sections designated centers receive telegraphic reports of rainfall and daily extremes of temperature from nearby points for publication in bulletin form, each local center receiving condensed reports from all others.

By the assistance of several thousand co-operative observers, many of whom have maintained local records for long periods, the Weather Bureau endeavors to collect special local data and thus perfect the records that are needed for the study of the relation between climate and agriculture, forestry, water resources, and other kindred subjects. The results of these observations appear in detail in monthly and annual reports published at the respective section centers.

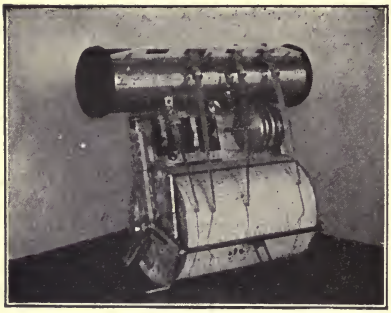
A division of the bureau, known as the Division of Agricultural Meteorology, has for its lines of work the application of meteorology to the needs and interests of agriculture; conducting studies of meteorological and climatic conditions in their relation to agriculture and the growth and yield of crops; conducting investigations of the effect of



THERMOMETER SHELTER AND RAIN GAGE
(Outfit of a "Co-operative Observer")

weather and climate upon plant growth; determination of the distribution of frost warnings and forecasts to special agricultural interests; conducting studies for the protection of crops and orchards from frosts, and distributing information as to the effect of the weather and climate on crops, through the medium of the National Weather and Crop Bulletin and other publications.

Among the publications of the Weather Bureau, the following are worthy of special notice:



MARVIN METEOROGRAPH SENT ALOFT WITH A KITE FOR UPPER-AIR INVESTIGATIONS

The Monthly Weather Review, which has been published regularly since January, 1873, and which contains elaborate meteorological tables and charts showing the weather conditions for the month over the United States and neighboring countries.

The reports of the sections of the Climate and Crop Service, showing in detail the climatic conditions of the month.

The Weekly Weather and Crop Bulletin, which gives in detail the weather conditions that have prevailed throughout the country during the week and its effects upon the crops.

The occasional bulletins, now numbering about seventy, containing the larger reports made by the experts of the service.

The library of the Weather Bureau contains about 32,000 books and pamphlets, consisting principally of technical books on meteorology and allied sciences, and of published climatological data from all parts of the world. It is available to all Weather Bureau officials and to students of meteorology generally, who either consult it personally or through correspondence. In addition to its general card catalogue, it keeps up to date a catalogue of the meteorological contents of the principal scientific serials of the world.

The Annual Report of the Chief of Bureau presents a full summary of climatic data for the United States.

The apparatus used at Weather Bureau stations for recording weather conditions is largely the result of improvements devised by the Instrument Division, to which is intrusted the care of all standards. The kites, meteorographs, self-registering instruments, and other forms of apparatus devised by the Weather Bureau are favorably known throughout the world.

The Bureau has a force of scientists and trained employees engaged in research work in connection with upper air conditions and solar radiation and investigations in seismology.

The extent to which the work of the Weather Bureau, in the collection and publication of data and the issue of weather forecasts and warnings, affects the daily life of the people and becomes a factor in their various avocations and business enterprises, already very great, is increasing yearly.

The uses made of the daily forecasts are so numerous and well known as to call for no remark, but the value to the manifold business interests of the country of the publication of weather data and the dissemination of warnings of exceptionally severe and injurious weather conditions, such as storms and hurricanes, cold waves, frosts, floods, heavy rains and snows, is not so generally understood. Of the warnings mentioned, those of storms and hurricanes, issued for the benefit of marine interests, are the most important and pecuniarily valuable. Storm warnings are displayed at nearly 300 points along the Atlantic, Pacific and Gulf coasts and the shores of the Great Lakes, including every port and harbor of any considerable importance; and so nearly perfect has this service become that scarcely a storm of marked danger to maritime interests has occurred

Photo Harris & Ewing

FORECASTING THE WEATHER AT THE WEATHER BUREAU, WASHINGTON, D. C.

for years for which ample warnings have not been issued from twelve to twenty-four hours in advance. The sailings of the immense number of vessels engaged in our ocean and lake traffic are largely determined by these warnings, and those displayed for a single hurricane are known to have detained in port on our Atlantic coast vessels valued, with their cargoes, at over $30,000,000.

The warnings of those sudden and destructive temperature changes known as cold waves are probably next in importance. These warnings, which are issued from twenty-four to thirty-six hours in advance, are disseminated throughout the threatened regions by means of flags displayed on regular Weather Bureau and sub-display stations, by telegraph, telephone, and mail service to all places receiving daily forecasts, and to a large number of special addresses in addition. The beneficial results of these warnings are manifold. Precautions are taken for the safeguarding of personal comfort and health, and the protection from freezing of produce of all kinds, steam and water pipes, hot house plants, and flowers. Railroads regulate the size and movement of their freight trains, ice men prepare for harvesting, and many plans for business and pleasure are made on the expectation of the conditions forecast. The warnings issued in January, 1896, for a single cold wave of exceptional severity and extent, resulted, according to reports, in the saving of over $3,500,000 in the protection of property from injury or destruction.

The warnings of frost and freezing weather are also of immense value, particularly to the fruit, sugar, tobacco, cranberry and market gardening interests. The early truck raising industry, so extensively carried on in the regions border-

WEATHER BUREAU STATION OF THE "OBSERVATORY" TYPE AT PEORIA

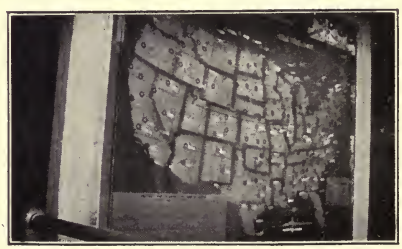
ing on the Gulf and South Atlantic coasts, and in Florida, and which has increased so greatly in the last few years, is largely dependent for its success on the co-operation of the Weather Bureau in this particular, and the growers of citrus and other fruits liable to injury by frosts or freezing weather have invested large sums in tents, screens, heating, smudging, and irrigating apparatus for the protection of their groves and orchards, which they put into use when notified by the bureau of the expected occurrence of injuriously low temperatures.

The commerce of our rivers is greatly aided and lives and property in regions subject to overflow are protected by the publication of the river stages and the issue of river and flood forecasts based on reports received from about five hundred special river and rainfall stations. On the occasion of the flood of 1897 in the lower Mississippi Valley live stock and other movable property to the estimated value of about $15,000,000 was removed from the inundated regions prior to the flood, as a result of the warnings by the bureau a week in advance of its occurrence.

In the raisin-growing districts of California rain forecasts are of great value. The raisin crop while growing is extremely susceptible to injury from rain, and the warnings enable the producers to protect the fruit by stacking and covering the trays. The accuracy of the rain forecasts for this region and the system for their distribution have been such that practically no loss from this cause has occurred for years.

Shippers of perishable produce and goods liable to injury by heat or cold are guided largely by the weather reports in making shipments and in directing their movements while on the road. Large dealers in produce, by careful attention to the daily reports and the weekly crop bulletins, inform themselves as to the regions where conditions most favorable for certain crops have occurred, and are thus enabled to judge of the probable supply and purchase to advantage. Constructors of waterworks, bridges, culverts, and sewers consult the rainfall records to ascertain the maximum water flow they will have to allow for. Architects of iron and steel structures and tall buildings study the records of maximum and minimum temperatures and wind velocity, in order to estimate the contraction and expansion and amount of wind pressure their buildings must be prepared to withstand.

From the information as to climatic conditions made known through the reports, invalids and tourists are enabled to select the locations best suited to their health and pleasure, and manufacturers and agriculturists the regions best adapted for the carrying on of their particular industries. By the recent expansion of



STREET WEATHER MAP, ATLANTIC CITY, N. J.

the system of snowfall observations throughout the mountain regions adjacent to the Great Plains, it has been made possible to forecast the probable flow in the rivers of the arid regions, a factor of great importance in irrigation. The records of the bureau are of frequent use as evidence in courts of law, for which purpose they have been decided competent evidence by the Supreme Court of the United States.

The conduct of the regular stations of observations outside of Washington requires the constant services of about six hundred, and the business of the Central Office at Washington of about two hundred employees. The annual disbursements of the bureau amount to about $1,600,000.

The numerous offices of the bureau throughout the country are always open during business hours and the public are cordially invited to visit them and avail themselves of the information contained in the records there on file.

BUREAU OF ANIMAL INDUSTRY

The Bureau of Animal Industry has charge of the work of the department relating to the live-stock industry. In general it deals with the investigation, control, and eradication of diseases of animals, the inspection and quarantine of live stock, the inspection of meat and meat food products, and with animal husbandry and dairying.

BUREAU OF PLANT INDUSTRY

The Bureau of Plant Industry studies plant life in all its relations to agriculture. The scientific work of the bureau is divided into twenty-seven distinct groups, over each of which is placed a scientifically trained officer, who reports directly to the chief and assistant chief of the bureau. The work of the bureau is conducted on the project plan, the investigations under each of the offices being arranged by group projects consisting of closely related lines of work, which group of projects are still further divided into projects.

THE WORK OF THE FOREST SERVICE*

The Forest Service is charged with the administration and protection of the 152 National forests. These forests comprise over 155 million acres of land, have an estimated stand of 600 billion board feet of timber, supply range for 14 million head of livestock, and contain water power valued at about $200,000,000. In addition to caring for the National forests, the Forest Service conducts investigations of improved methods of utilizing and marketing all classes of forest products; carries on studies to determine possible uses for wood waste, and co-operates with private individuals and corporations in solving problems relative to the use of wood in general. Under the provisions of the Weeks Law, the Forest Service examines lands in the Southern Appalachian and White Mountain regions which are offered for sale to the Government and protects and administers such lands after their purchase, in addition to co-operating with various States in forest fire protection. Finally, information in regard to the relation of forests to the general welfare is collected and disseminated.

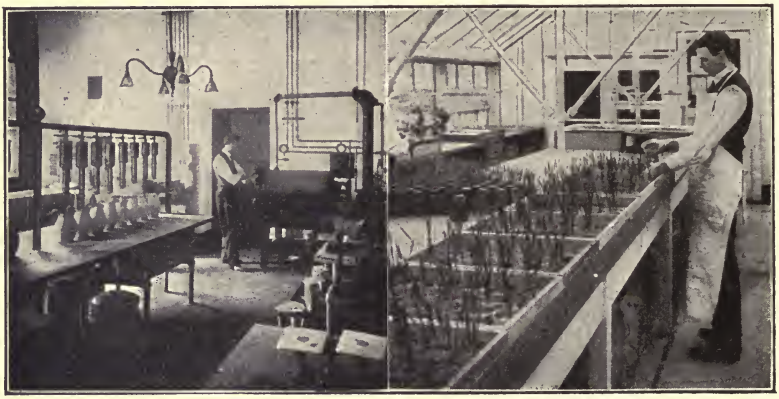
*This subject is so important that a special illustrated chapter will be found in the first part of this book. See page 75.

BUREAU OF CHEMISTRY

The Bureau of Chemistry is concerned with analytical work and investigation under the food and drugs act, questions of agricultural chemistry of public interest, and other chemical investigations referred to it by the Department of Agriculture.

BUREAU OF SOILS

The Bureau of Soils investigates the relation of soils to climate and organic life; studies the texture and composition of soils in field and laboratory; maps the soils; studies the cause and means of preventing the rise of alkali in soils of irrigated areas, and the relation of soils to seepage and drainage conditions.



SOIL FERTILIZER INVESTIGATIONS PLANT HOUSE

BUREAU OF ENTOMOLOGY

The Bureau of Entomology studies insects; experiments with the introduction into the United States of beneficial insects; makes tests with insecticides and insecticide machinery; identifies insects sent in by inquirers. It is practically solely a research organization and studies the insects which are injurious to various crops and domestic animals, and to man himself, in the hope of learning the cheapest and most effective remedies and preventives. It expends an annual appropriation of about $850,000, and employs some six hundred men, more than two hundred of whom are scientifically trained.

BUREAU OF BIOLOGICAL SURVEY

The work of the Bureau of Biological Survey is distributed among four divisions, dealing with the following matters: (1) Study of birds and mammals in their relation to agriculture, their food habits, etc., and recommendation of measures for the preservation of beneficial species and the destruction of harmful species, also experiments in fur farming; (2) making biological surveys, study of geographic distribution of animals and plants, and mapping natural life zones; (3) carrying into effect the Federal laws protecting game and regulating the importation of foreign birds and animals; and (4) general supervision of the Federal migratory bird law.

SPRAYING TREES IS A GREAT HELP TO THE FARMER

DIVISION OF ACCOUNTS AND DISBURSEMENTS

This division has charge of the disbursement of public funds appropriated for the Department of Agriculture.

DIVISION OF PUBLICATIONS

The Division of Publications conducts all business of the department transacted with the Government Printing Office; has general supervision of the printing, indexing, binding, and distribution of publications, and the maintenance of mailing lists.

BUREAU OF CROP ESTIMATES

The Bureau of Crop Estimates issues the monthly crop reports based on data collected by salaried field agents and a corps of approximately 150,000 voluntary crop reporters, every State, county and agricultural township being represented. The monthly crop reports contain annual estimates of numbers of different classes of live stock on farms and losses due to disease and exposure, annual estimates of acreage planted and acreage harvested of the principal crops, monthly reports of the condition of about sixty different crops during the growing season, monthly forecasts of yields per acre and total production, monthly reports of farm prices of all crops and classes of live stock, and in December estimates of total production of all the principal crops. The monthly reports of condition and forecasts of production are issued to the press associations in Washington and telegraphed to the Weather Bureau Station Directors in all the States for prompt dissemination to the local press, and at the close of the year

annual estimates of crop and live stock production are published in the Yearbook of the Department. The bureau also furnishes estimates of the United States crops to the International Institute of Agriculture at Rome, Italy, and in return receives from the Institute crop estimates for all adhering countries, which are issued to the press through the Office of Information. The bureau compiles statistics and furnishes information relating to the agriculture of the United States and foreign countries in response to special inquiries.

HOW A WELL PACKED AND A POORLY PACKED BASKET OF LETTUCE ARRIVED AT MARKET

LIBRARY

The department library contains 137,000 books and pamphlets, including an extensive collection on agriculture, a large and representative collection on the sciences related to agriculture, and a good collection of standard reference books. Periodicals currently received number 2,337. A dictionary catalogue is kept on cards, which number about 325,000. The librarian has charge of the foreign mailing lists.

STATES RELATIONS SERVICE

The States Relations Service of the United States Department of Agriculture administers the Hatch and Adams acts providing Federal aid for the State agricultural experiment stations and the Smith-Lever act providing for co-operative extension work in agriculture and home economics. It also has charge of the farmers' co-operative demonstration work conducted by the Department of Agriculture, makes investigations relating to agricultural schools, farmers' institutes, and home economics, and directs the work of the agricultural experiment stations in Alaska, Hawaii, Porto Rico and Guam. The service issues Experiment Station Record, a periodical technical review of the world's scientific literature pertaining to agriculture besides various publications relating to its special lines of work.

OFFICE OF PUBLIC ROADS AND RURAL ENGINEERING*

The Office of Public Roads and Rural Engineering has charge of all work within the Department of Agriculture which is of an agricultural nature involving engineering or mechanical principles, together with the supervision of all road work under the Federal Aid Road Act. For carrying out this work the office is divided into two main branches, known respectively as (1) Management and Economics, (2) Engineering, and these are subdivided into lines of work as follows: Management; Engineering Economics; Road Materials Tests and Research; Highway Construction and Maintenance; Irrigation; Drainage; Rural Engineering. For convenience in Federal Aid road work ten field districts have been established, and in addition to the general organization there are two general inspectors who report to the director of the office. With regard to character the work may, however, be more conveniently grouped into three general classes, as follows: (1) Education or extension; (2) investigations or research; and (3) the supervision of the road work under the Federal Aid Road Act, the administration of which was placed by Congress under the Secretary of Agriculture.

The educational or extension work includes reaching the people by means of lectures, addresses, the publication of bulletins, the exhibition of models, etc., and thus teaching the economic value of science and experience in the improvement and care of roads, the necessity and the methods for obtaining adequate land drainage, the economic importance of farm irrigation and practical methods, the meaning and possibilities of modern farm conveniences, not for the farm only, but also for the farm home, and the intelligent utilization of farm equipment and machinery.

Special advice and assistance is also frequently given where the problems to be solved involve a knowledge of community and co-operative administration and of methods for planning and financing such works as a better system of roads or the irrigation or drainage of a district. Here the questions are specific rather than general and the lecturer gives way to the engineer. Not infrequently the assistance takes the form of an actual demonstration of construction under Government supervision. In fact, the office then becomes practically an object lesson school for road construction, the proper methods of farm irrigation or land drainage.

The research and experimental work of the office has become exceedingly important and varied by reason of the many problems, not only in road construction and maintenance to which modern traffic conditions have given rise, but also in connection with the drainage and irrigation of agricultural lands and in the development of the various structures, appliances and equipment necessary for adequately conducting farm operations. Proper co-ordination between the investigations conducted in the laboratories and the results obtained from field experiments and actual practice is constantly sought, and the laboratories have been specially equipped so as to further this object.

Under the Federal Aid Road Act of July 11, 1916, the Secretary of Agriculture is authorized to co-operate with the States through their respective State highway departments in the construction and improvement of rural post roads. The act provides for a comprehensive program extending over a period of five years, with an appropriation of $5,000,000 for the fiscal year 1917, and increasing annually by $5,000,000 to $25,000,000 for the fiscal

*The subject of "Good Roads" forms a chapter. See page 103.

year 1921. The appropriations are apportioned to the several States on the basis of population, area, and mileage of rural free deiivery and star routes, each factor having a weight of one-third. The amount apportioned by the Federal Government must be at least duplicated by the State. The same act also provides for an annual appropriation of $1,000,000 for a period of ten years for the construction of roads and trails within or partly within the national forest reserves.

OFFICE OF MARKETS AND RURAL ORGANIZATION

This office secures and distributes information regarding the marketing and distributing of farm and non-manufactured food products. It conducts a demonstration telegraphic market news service regarding fruits and vegetables, and

COMBINATION PACKAGE FOR POSTAL DELIVERY OF EGGS, BUTTER AND CELERY OR CHICKENS

a service by mail concerning the commercial surpluses of some other less perishable crops. It is beginning a similar service upon live stock and meats. Co-operation among farmers is studied, with a view to helping them to help themselves in matters of rural marketing, credit, insurance, and communication. It co-operates with various States in conducting marketing investigations. Under authority given to the Secretary of Agriculture by law it is responsible to him for the proper enforcement of the United States Cotton Futures Act and the Warehouse Act, and in co-operation with the Bureau of Plant Industry of the enforcement of the Grain Standards Act. This office is being appreciated.

CHAPTER XIII.

DEPARTMENT OF COMMERCE

SECRETARY OF COMMERCE

THE Secretary of Commerce is charged with the work of promoting the commerce of the United States and its mining, manufacturing, shipping, fishery, and transportation interests. His duties also comprise the administration of the Lighthouse Service and the aid and protection to shipping thereby; the taking of the census and the collection and publication of statistical information connected therewith; the making of coast and geodetic surveys; the collecting of statistics relating to foreign and domestic commerce; the inspection of steamboats, and the enforcement of laws relating thereto for the protection of life and property; the supervision of the fisheries as administered by the Federal Government; the supervision and control of the Alaskan fur-seal, salmon, and other fisheries; the jurisdiction over merchant vessels, their registry, licensing, measurement, entry, clearance, transfers, movement of their cargoes and passengers, and laws relating thereto, and to seamen of the United States; the regulation of the enforcement and execution of the act of Congress relating to the equipment of ocean steamers with apparatus and operators for wireless communication; the custody, construction, maintenance, and application of standards of weights and measurements; the gathering and supplying of information regarding industries and markets for the fostering of manufacturing; and the formulation (in conjunction with the Secretaries of Ag-

Photo Brown & Dawson

THE MIGHTY "IMPERATOR" STEAMING PAST THE GREATEST CREATIONS ON LAND

riculture and the Treasury) of regulations for the enforcement of the food and drugs act of 1906 and the insecticide act of 1910. He has power to call upon other departments for statistical data obtained by them.

For the proper accomplishment of any or all of the aforesaid work it is by law provided that all duties performed, and all the powers and authority possessed or exercised, at the date of the creation of said department, by the head of any executive department in and over any bureau, office, officer, board, branch, or division of the public service transferred to said department, or any business arising therefrom or pertaining thereto, or in relation to the duties and authority conferred by law upon such bureau, office, officer, board, branch, or division of the public service, whether of appellate or advisory character or otherwise, are vested in and exercised by the Secretary of Commerce.

The act creating the Department of Labor, approved March 4, 1913, changed the name of the Department of Commerce and Labor to the Department of Commerce. Under the terms of this act the Bureau of Labor, Bureau of Immigration, Division of Naturalization, and Children's Bureau were detached from the Department of Commerce and Labor and organized as the new Department of Labor.

ASSISTANT SECRETARY OF COMMERCE

The Assistant Secretary performs such duties as shall be prescribed from time to time by the Secretary or may be required by law. In the absence of the Secretary he acts as head of the department.

CHIEF CLERK

The chief clerk is charged with the general supervision of the clerks and employees of the department; the enforcement of the general regulations of the department; the superintendency of all buildings occupied by the department in the District of Columbia; the general supervision of all expenditures from the appropriations for contingent expenses and rents; the receipt, distribution, and transmission of the mail; the supervision of the library and the stock and shipping section of the department; and the discharge of all business of the office of the Secretary not otherwise assigned.

DISBURSING CLERK

The disbursing clerk is charged by the Secretary of Commerce with the duty of preparing all requisitions for the advance of public funds from appropriations for the Department of Commerce to disbursing clerks and special disbursing agents charged with the disbursement of public funds; the keeping of appropriation ledgers relating to the advance and expenditure of all items of appropriations. He has charge of the issuing, recording, and accounting for Government requests for transportation issued to officers of the department for official travel; the audit and payment of all vouchers and accounts submitted from the various offices, bureaus, and services of the department (except the Coast and Geodetic Survey and those services having special disbursing agents); and the general accounting of the department.

APPOINTMENT DIVISION

The Chief of the Appointment Division is charged by the Secretary of Commerce with the supervision of matters relating to appointments, transfers, promotions, reductions, removals, and all other changes in the personnel, including applications for positions and recommendations concerning the same, and the correspondence connected therewith; the preparation and submission to the Secretary of all material for the Official Register, and the custody of oaths of office, records pertaining to official bonds, service records of officers and employees, correspondence and reports relating to personnel, reports of bureau officers respecting efficiency of employees, and records relating to leaves of absence.

DIVISION OF PUBLICATIONS

The Chief of the Division of Publications is charged by the Secretary of Commerce with the conduct of all business the department transacts with the Government Printing Office; the general supervision of printing, including the editing and preparation of copy, illustrating and binding, the distribution of publications, and the maintenance of mailing lists. The advertising done by the department is in his charge. He also keeps a record of all expenditures for publishing work of the department and conducts the correspondence it entails.

DIVISION OF SUPPLIES

Under the direction of the chief clerk the Chief of the Division of Supplies has personal supervision of all the work incident to the purchase and distribution of supplies for the department proper and for the services of the department outside of Washington, and of the keeping of detailed accounts of all expenditures from the appropriation for contingent expenses of the department. He receives, verifies, and preserves the semi-annual returns of property from the offices and bureaus of the department which are supplied from the contingent appropriation, and examines and reports on the semi-annual property returns of all other bureaus and services of the department.

BUREAU OF FOREIGN AND DOMESTIC COMMERCE*

The Bureau of Foreign and Domestic Commerce is concerned primarily with the collection of information concerning foreign markets and the dissemination of this information for the use and benefit of American commercial interests. For the collection of information the bureau depends chiefly upon the American consular service, upon the ten commercial attachés appointed by the bureau, and upon a corps of fifteen to twenty-five traveling special agents.

The consuls submit reports to the State Department on a variety of commercial subjects, and once a year prepare a review of the commercial and industrial activities of the district to which they are assigned. These reports are turned over to the Bureau of Foreign and Domestic Commerce for publication.

There are commercial attachés at London, Paris, Berlin, Petrograd, Peking, Melbourne, Rio de Janeiro, Buenos Aires, Lima, and Santiago (Chile). They are attached to the embassies or legations, but confine their attention to commercial affairs. They have been termed "business diplomats" and "ambassadors of industry." This service has recently completed a world-wide survey of the markets for American hardware, the first that has ever been made.

The special agents are specialists. If it is desired to learn the possibilities of selling boots and shoes in South America, for instance, a man is selected by examination who knows the business thoroughly, who can speak Spanish fluently, and who can report well what he learns. This man is then sent to South American countries to spend a year or two studying the subject. Since the war started the activities of the special agents have been largely centered in South America and the Far East.

The information gathered by the consuls, attachés and agents is distributed from the central office at Washington. The shorter current reports are published in the daily "Commerce Reports," which has a paid circulation of nearly 10,000. The longer and more specialized reports are published in the form of monographs, ranging in length from 16 to 500 pages. There are books of this kind on the cotton-goods markets of nearly every country in the world. The reports of the attachés on the hardware markets are being published in this form. Specific opportunities to secure foreign business are published as "Trade Oppor-

*See page 231 for "The Recent Development of American Commerce," by Secretary Redfield, and "Commercial and Industrial Preparedness," by Dr. E. E. Pratt, Chief of the Bureau, page 245.

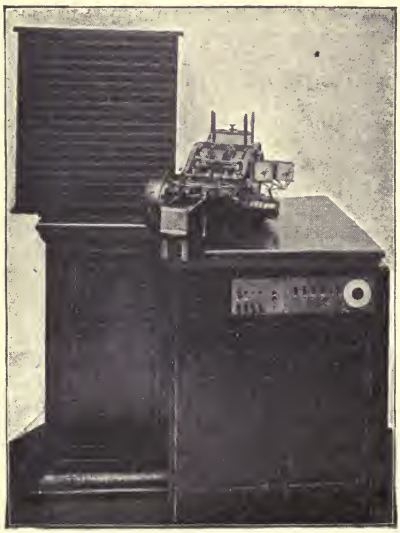
tunities," on the back page of "Commerce Reports," with names and addresses omitted. The information withheld can be obtained by any American firm of known standing upon application to the bureau. Hundreds of thousands of dollars worth of business is brought to the United States in this manner. Upon occasion special bulletins are sent to manufacturers and exporters.

To facilitate the distribution of trade information the bureau has recently established district offices at New York, Boston, Atlanta, Chicago, St. Louis, New Orleans, San Francisco, and Seattle. What are termed "co-operative offices" have been established at Philadelphia, Chattanooga, Cincinnati, Cleveland, Los Angeles and Portland, Ore. These co-operative offices are in reality foreign-trade departments of the local chambers of commerce which have made special arrangements to furnish the same information service in their districts as the regular district offices furnish in theirs.

The foreign-trade statistics used so extensively in the public press are compiled by the Bureau of Foreign and Domestic Commerce from custom house documents, in co-operation with the Treasury Department. These statistics are published monthly, quarterly, and yearly.

THE BUREAU OF THE CENSUS

A census of the population of the United States has been taken decennially by the Federal Government, beginning in 1790. The Constitutional requirement of a decennial census is found in Article 1, Section 3, which directs that Representatives and direct taxes shall be apportioned among the several States according to their respective numbers, as ascertained by actual enumeration, to be made once in ten years.



CENSUS TABULATING MACHINE

From decade to decade the scope of the census was extended to include not only a great amount of detail with respect to the population but also other entirely distinct lines of inquiry, such as agriculture, manufactures, etc.

In 1902 the Census Office was by law made a permanent branch of the Department of the Interior under the name "Bureau of the Census." A year later it was transferred to the newly created Department of Commerce and Labor, and since March 4, 1913, it has been a bureau of the Department of Commerce.

The last decennial census covered the subjects of population, agriculture, manufactures and mines and quarries and oil and gas wells.

During the years intervening between decennial censuses the bureau conducts decennial inquiries relating to wealth, debt and taxation, to dependent, defective and delinquent classes, to religious bodies, to fisheries and to transportation by water; quinquennial inquiries in re-

gard to manufactures, central electric light and power stations, street and electric railways and telegraphs and telephones; annual collections of birth and death statistics and of financial and other statistics of cities; semi-annual inquiries as to stocks of leaf tobacco held by manufacturers and dealers; and periodical collections, at intervals averaging less than one month, of statistics relating to cotton and cottonseed.

Special inquiries are occasionally devolved upon the bureau by Congress, by the President or by the Secretary of Commerce.

The Census Bureau has developed its tabulating machinery to an extraordinarily high degree of efficiency, so that by its aid the average output of the clerks engaged in routine tabulation is increased many fold. The illustration on the preceding page shows the machine by which the final process of mechanical tabulation is performed. Punched cards are automatically fed into this machine at the rate of 400 or more per minute, and the statistical facts indicated on them by the positions of the holes are electrically recorded with unerring accuracy.

Photo by Harris & Ewing

"ON YOUR MARK!" AWAITING THE SIGNAL RELEASING CROP REPORTS

Reporters waiting to rush to telephones

BUREAU OF STANDARDS

The functions of the Bureau of Standards are as follows: The custody of the standards; the comparison of the standards used in scientific investigations, engineering, manufacturing, commerce, and educational institutions with the standards adopted or recognized by the Government; the construction, when necessary, of standards, their multiples and subdivisions; the testing and calibration of standard measur-

ing apparatus; the solution of problems which arise in connection with standards; the determination of physical constants and properties of materials, when such data are of great importance to scientific or manufacturing interests and are not

cipal government within the United States, or for any scientific society, educational institution, firm, corporation, or individual within the United States engaged in manufacturing or other pursuits requiring the use of standards or standard measuring

TEST SET OF WEIGHTS AND MEASURES RECOMMENDED BY THE U. S. BUREAU OF STANDARDS

to be obtained of sufficient accuracy elsewhere; and other investigations as authorized by Congress. The bureau is authorized to exercise its functions for the Government of the United States, for any State or municipal government within the United States, or for any scientific society, educational institution, firm, corporation, or individual within the United States engaged in manufacturing or other pursuits requiring the use of standards or standard measuring instruments. For all comparisons, calibration tests, or investigations, except those performed for the Government of the United States or State governments, a reasonable fee will be charged.

BUREAU OF LIGHTHOUSES

The work of the Bureau of Lighthouses is given in the chapter on the "Government Protection of Life and Property at Sea," page 135.

BUREAU OF FISHERIES

The work of the Bureau of Fisheries is given in the special chapter on "The Fish We Eat." See page 67.

UNITED STATES COAST AND GEODETIC SURVEY

The work of the United States Coast and Geodetic Survey is given in the chapter on "The Three Great Government Surveys," page 127.

BUREAU OF NAVIGATION

By HON. EUGENE TYLER CHAMBERLAIN

Commissioner of Navigation

THE Federal Government exercises general superintendence over merchant shipping through the Bureau of Navigation of the Department of Commerce. To engage in trade or in the fisheries, vessels in the United States must first secure a permit from the Government; that is to say, vessels of which the contents are 500 cubic feet or more. Smaller boats are not required to get this permit, nor are barges, lighters and similar craft employed only in harbors or on canals and waters not subject to Federal jurisdiction. The issue of these permits is based on the clause of the Constitution which gives the Federal Government the power to regulate commerce with foreign nations and between the States. These permits are called registers if the vessel is to engage in foreign trade, and enrollments or licenses if the vessel is to engage solely in trade between American ports. Collectors of Customs issue annually these papers, of which there are over 26,000, but the Bureau of Navigation superintends the work and decides all doubtful questions. The Bureau also decides all questions about measuring the cubical contents of the vessel, a somewhat intricate task performed by custom house officers. As various charges, Federal, local and private, are based on the size of vessels, the Federal Government through the Bureau of Navigation endeavors to see that the rules of measurement are enforced uniformly. Foreign nations follow the same general method of issuing documents to their ships and measuring their size as does the United States—indeed, the laws of the United States on ships' registers date back to the time of Alexander Hamilton, first Secretary of the Treasury, who adopted the British system.

"Dixie" "Tarragon"

BUREAU OF NAVIGATION FLEET

The only important tax imposed by the Federal Government on ships in foreign trade is a duty on their tonnage or cubical contents, which may not exceed annually 30 cents a ton, or 100 cubic feet, on ships in trade with the more remote continents, or 10 cents annually on ships in trade with the nearby foreign ports of North America and adjacent islands. This Federal tax law is also enforced by Collectors of

Customs under direction of the Bureau of Navigation. The tax is imposed uniformly on American and foreign ships.

Every maritime nation supervises the labor contracts entered into by the seamen on its merchant vessels engaging in foreign trade. This supervision is to prevent frauds upon seamen, to prevent their being left stranded in foreign ports and to enable the seaman to know in advance just what work he has agreed to perform, the course and duration of the voyage, the fare he is to receive on board and the pay he is to get. These contracts are made in writing on printed Government forms and are signed by a shipping commissioner or collector of customs as a representative of the Government. When the contract has been performed and the voyage ended, the seamen are paid off and discharged before the shipping commissioner. Governments are specially interested in the whereabouts and welfare of their merchant seamen, as in many countries they are reckoned an asset in national defense. During the past fiscal year 487,524 officers and men signed such agreements and were later paid off and discharged by the commissioners, some men appearing in the total as often as the number of voyages they made. It requires 60,000 officers and men to man the ocean-going merchant ships and yachts under the American flag, and the Bureau of Navigation of the Commerce Department has general supervision over the shipping and discharge of crews under the method outlined. The American Navy now has about 55,000 enlisted men, and officers and the Marine Corps bring the total beyond the number in the merchant service. When the warships recently ordered are in commission four or five years hence the Navy will require 77,000 enlisted men.

The Bureau of Navigation also supervises the laws requiring wireless apparatus and operators on ships and requiring wireless apparatus and operators on sea or land to be licensed and to conform to requirements of the international treaty and American law designed to prevent the interference of wireless stations with one another. To carry out these laws and the treaty the Bureau has radio inspectors at the principal seaports and Great Lake ports to inspect wireless apparatus on ships before their departure and make sure that the main apparatus is efficient and that the auxiliary apparatus, employed if the main apparatus is put out of operation by accident at sea, is ready for use. In the last fiscal year these officers made 7,236 inspections of ships before leaving port.

The laws of the United States regulating American merchant ships and foreign merchant ships in American ports fill a volume of considerable size, popularly termed the Navigation Laws. These laws are designed partly to insure the safety of passengers and crews, partly to prevent the misuse of the American flag, to secure revenue and to prevent frauds on the revenue, to promote American shipbuilding, to secure comfortable quarters for steerage passengers, to prevent collisions, fire and other casualties, to secure efficient officers and sufficient crews, to furnish complete statistical records within limits, to regulate trade with foreign ports and between American ports, including those in Alaska, Hawaii and Porto Rico, and for many other purposes. Violations of these laws involve penalties of greater or less severity and from the beginning of Government it has been found necessary to lodge somewhere discretionary power to mitigate or remit such penalties when circumstances warranted that action, the full statutory penalties being imposed in flagrant and willful cases. This discretionary power is lodged in the Secretary of Commerce, and the preliminary investigation of such matters is made for him by the Bureau of Navigation,

which ascertains all the facts and recommends a course of action to the Secretary. Last year 7,895 such cases were examined by the Bureau of Navigation. At seaports violations of law are reported by collectors of customs, radio inspectors, Coast Guard officers, inspectors specially designated to see to it that steamers, especially excursion steamers, do not leave port with more passengers than can be safely carried, and by steamboat-inspection officers. Each owner, master, officer or man charged with violation of law has an opportunity to offer his defense or excuse in writing, and the evidence is then weighed by the Bureau of Navigation and a recommendation made to the head of the department.

Since motor boats began to furnish the means of water transportation for many parts of the country and motor boating became a national sport the navigation laws have come close to thousands of Americans who before were only remotely aware of their existence. There are about 250,000 motor boats on the waters of the United States. The Bureau of Navigation has two motor boats of its own ("Dixie" and "Tarragon") which are almost constantly engaged in securing compliance with the laws among vessels generally, but especially among motor boats. They cover the Atlantic coast from Eastport, Me., to Key West, Fla., visiting the intervening bays, harbors, sounds and rivers during the seasons of greatest local activity, and have proved to be an efficient and economical means of securing strict compliance with the navigation laws.

THE STEAMBOAT INSPECTION SERVICE

By D. N. HOOVER, Jr.

Acting Supervising Inspector General

ORGANIZATION

THE head of the Steamboat Inspection Service is the Supervising Inspector General, who is stationed at Washington, and under the Supervising Inspector General is the Deputy Inspector General.

In addition to the clerical force at Washington there work directly under the supervision of the central office, two traveling inspectors, one located at New York, N. Y., and the other at San Francisco, Cal., whose business it is to re-examine vessels with a view to ascertaining whether the local inspectors have properly inspected the same, and also to follow up complaints that may be referred to them by the central office.

A corps of assistant inspectors, detailed for duty at the steel mills for the purpose of testing plate to be used in construction of marine boilers, also works under the direct supervision of the central office.

The United States, including Hawaii, Alaska and Porto Rico, is divided into ten supervising inspection districts, over each of which districts presides a supervising inspector.

The Supervising Inspector General and the ten supervising inspectors above referred to constitute the Board of Supervising Inspectors, which meets in annual session the third Wednesday of January each year for the purpose of establishing all necessary regulations required to carry out in the most effective manner the laws that relate to the Steamboat Inspection Service.

Each Supervising inspection district is divided into local inspection districts. Over each local inspection district a board of local inspectors, consisting of an inspector of hulls and an inspector of boilers, presides. In those districts where the pressure

of work requires it, there are also stationed assistant inspectors, who work under the supervision of the board of local inspectors of the district.

ACTIVITIES OF THE SERVICE

The Service exists for the purpose of inspecting vessels, licensing officers and conducting investigations of disasters and violations of law.

Once each year, steamers subject to inspection are required to have the hulls of the same thoroughly examined, and the inspectors must satisfy themselves that such vessels are of a structure suitable for the service in which they are to be employed, have suitable accommodations for passengers and crew, and are in a condition to warrant the belief that they may be used in navigation as steamers with safety to life, and the inspectors have to satisfy themselves that all the requirements of law in regard to fires, boats, pumps, hose, life preservers, floats, anchors, cables, and other things are faithfully complied with. Furthermore, all excursion and ferry steamers are required to be reinspected three times during the year for which certified or during the period of navigation. Local inspectors are also required to inspect the boilers and their appurtenances in all steam vessels before the same shall be used, and once at least in every year thereafter, are required to subject all boilers to hydrostatic pressure. They must assure themselves that the boilers are well made, of good and suitable material; that the openings for the passage of water and steam, respectively, and all pipes and tubes exposed to heat, are of proper dimensions and free from obstructions; that the spaces between and around the flues are sufficient; that flues, boilers, furnaces, safety valves, fusible plugs, low-water indicators, feed-water apparatus, gauge cocks, steam gauges, water and steam pipes connecting boilers, means of prevention of sparks and flames from fire doors, low-water gauges, means of removing mud and sediment from boilers, and all other such machinery and appurtenances thereof, are of such construction, shape, condition, arrangement, and material that they may be safely employed in the service proposed without peril to life.

Applicants for licenses from the Service obtain the same in all instances, except in the case of operators for motor boats, after due written examination before the local inspectors having jurisdiction, and in the case of deck officers, in addition to the written examination, they are examined as to color-sense and visual acuity. As a result of the Seamen's Act, the Service also certificates able seamen and lifeboat men.

The boards of local inspectors have authority by statute to investigate disasters and violations of law, and when they are conducting such investigations they are proceeding in a quasi judicial manner, and by statute certain appeals are provided from the local inspectors to the supervising inspectors, and in certain instances, to the Supervising Inspector General.

Inspection of a Hull for Reinforcing
Testing Life Boat of Passenger Steamer

Inside a Boiler on an Ohio River Steamer

Inspecting Life Preservers
Life Boat Drill on the Great Lakes

THE WORK OF THE FEDERAL STEAMBOAT INSPECTION SERVICE

CHAPTER XIV.

DEPARTMENT OF LABOR

THE SECRETARY OF LABOR

THE Secretary of Labor is charged with the duty of fostering, promoting, and developing the welfare of the wage earners of the United States, improving their working conditions, and advancing their opportunities for profitable employment. He has power under the law to act as mediator and to appoint commissioners of conciliation in labor disputes whenever in his judgment the interests of industrial peace may require it to be done. He has authority to direct the collecting and collating of full and complete statistics of the conditions of labor and the products and distribution of the products of the same and to call upon other departments of the Government for statistical data and results obtained by them and to collate, arrange, and publish such statistical information so obtained in such manner as to him may seem wise. His duties also comprise the gathering and publication of information regarding labor interests and labor controversies in this and other countries; the supervision of the immigration of aliens, and the enforcement of the laws relating thereto, and to the exclusion of Chinese; the direction of the administration of the naturalization laws; the direction of the work of investigating all matters pertaining to the welfare of children and child life and to cause to be published such results of these investigations as he may deem wise and appropriate.

The law creating the Department of Labor provides that all duties performed and all power and authority possessed or exercised by the head of any executive department at the time of the passage of the said law, in and over any bureau, office, officer, board, branch, or division of the public service by said act transferred to the Department of Labor, or any business arising therefrom or pertaining thereto, or in relation to the duties performed by and authority conferred by law upon such bureau, officer, office, board, branch, or division of the public service, whether of an appellate or advisory character or otherwise, are vested in and exercised by the head of the said Department of Labor. The Secretary of Labor is also given authority and directed to investigate and report to Congress a plan of co-ordination of the activities, duties, and powers of the office of the Secretary of Labor with the activities, duties, and powers of the present bureaus, commissions, and departments, so far as they relate to labor and its conditions, in order to harmonize and unify such activities, duties, and powers, with a view to additional legislation to further define the duties and powers of the Department of Labor, and to make such special investigations and reports to the President or Congress as may be required by them or which he may deem necessary, and to report annually to Congress upon the work of the Department of Labor.

ASSISTANT SECRETARY OF LABOR

The Assistant Secretary performs such duties as shall be prescribed by the Secretary or may be required by law. He becomes the Acting Secretary of Labor in the absence of the Secretary.

CHIEF CLERK

The chief clerk is charged with the general supervision of the clerks and employees of the department; the enforcement of the general regulations of the department; the superintendency of all buildings occupied by the department in the District of Columbia; the general supervision of all expenditures from the appropriations for contingent expenses and rents; the receipt, distribution, and transmission of the mail, and the discharge of all business of the Secretary's office not otherwise assigned.

DISBURSING CLERK

The disbursing clerk is charged by the Secretary of Labor with the duty of preparing all requisitions for the advance of public funds from appropriations for the Department of Labor to disbursing clerks and special disbursing agents charged with the disbursement of public funds; the keeping of appropriation ledgers relating to the advance and expenditure of all items of appropriations. He has charge of the issuing, recording, and accounting for Government requests for transportation issued to officers of the department for official travel; the audit and payment of all vouchers and accounts submitted from the various offices, bureaus, and services of the department; the general accounting of the department; and the accounting for all naturalization receipts received under the provisions of the act of June 29, 1906.

APPOINTMENT CLERK

The appointment clerk has charge of all clerical work incident to appointments which are made under the jurisdiction of the department. He is custodian of oaths of office, bonds of officers, personnel files, and efficiency reports.

DIVISION OF PUBLICATIONS AND SUPPLIES

The Chief of the Division of Publications and Supplies is charged by the Secretary of Labor with the conduct of all business the department transacts with the Government Printing Office; the general supervision of printing, including the editing and preparation of copy, illustrating and binding, the distribution of publications, and the maintenance of mailing lists. All blank books and blank forms and the printed stationery of all kinds used by the bureaus and offices of the department in Washington and the various outside services of the department are in his custody and are supplied by him. The advertising done by the department is in his charge. He also keeps a record of all expenditures for the publishing work of the department and conducts the correspondence it entails. Under the direction of the chief clerk he has personal supervision of all the work incident to the purchase and distribution of supplies for the department proper and for the services of the department outside of Washington and of the keeping of detailed accounts of all expenditures from the appropriation for contingent expenses of the department. He receives, verifies, and preserves the semiannual returns of property from the offices and bureaus of the department which are supplied from the contingent appropriation, and examines and reports on the semi-annual property returns of all other bureaus and services of the department.

BUREAU OF IMMIGRATION

The Bureau of Immigration is charged with the administration of the laws relating to immigration and of the Chinese-exclusion laws. It supervises all expenditures under the appropriation for "Expenses of regulating immigration." It causes alleged violations of the immigration, Chinese-exclusion, and alien contract-labor laws to be investigated, and when prosecution is deemed advisable submits evidence for that purpose to the proper United States district attorney.

DIVISION OF INFORMATION

The division of information, under the Bureau of Immigration, gathers from all available sources information concerning the resources, products, and physical characteristics of the States and Territories. This information is made available to admitted aliens and others seeking homes or places of settlement.

Under the direction of the Secretary of Labor, the division also acts as a division for the distribution and employment of labor, and is the central office of the eighteen distribution zones covering the entire United States. In this phase of its activities it co-operates with the Post Office Department, the Department of Agriculture, and the Department of the Interior.

BUREAU OF NATURALIZATION

The act approved March 4, 1913, creating the Department of Labor, provided a Bureau of Naturalization, and that the Commissioner of Naturalization, or, in his absence, the Deputy Commissioner of Naturalization, shall be the administrative officer in charge of the Bureau of Naturalization and of the administration of the naturalization laws under the immediate direction of the Secretary of Labor. Under the provisions of the act of June 29, 1906, naturalization jurisdiction was conferred upon approximately 3,500 United States and State courts. The duties of the Bureau of Naturalization are to supervise the work of these courts in naturalization matters, to conduct all correspondence relating to naturalization, and, through its field officers located in various cities of the United States, to investigate the qualifications of the candidates for citizenship and represent the Government at the hearings of petitions for naturalization. In the archives of the bureau are filed duplicates of all certificates of naturalization granted since September 26, 1906, as well as the preliminary papers of all candidates for citizenship filed since that date, averaging an annual receipt of approximately 450,000 naturalization papers.

BUREAU OF LABOR STATISTICS

The Bureau of Labor Statistics is charged with the duty of acquiring and diffusing among the people of the United States useful information on subjects connected with labor in the most general and comprehensive sense of that word, and especially upon its relations to capital, the hours of labor, the earnings of laboring men and women, and the means of promoting their material, social, intellectual, and moral prosperity.

It is especially charged to investigate the causes of and facts relating to controversies and disputes between employers and employees as they may occur, and which may happen to interfere with the welfare of the people of the several States.

It is also authorized, by act of March 2, 1895, to publish a bulletin on the condition of labor in this and other countries, condensations of State and foreign labor reports, facts as to conditions of employment, and such other facts as may be deemed of value to the industrial interests of the United States. This bulletin is issued in a number of series, each dealing with a single subject or closely related group of subjects, and the bulletin is published at irregular intervals as matter becomes available for publication.

By the act to provide a government for the Territory of Hawaii, as amended, it is made the duty of the bureau to collect and present in quinquennial reports statistical details relating to all departments of labor in the Territory of Hawaii, especially those statistics which relate to the commercial, industrial, social, educational and sanitary condition of the laboring classes.

The administration of the act of May 30, 1908, granting to certain employees of the United States the right to receive from it compensation for injuries sustained in the course of their employment, is vested in the bureau by the act of March 4, 1913, creating the Department of Labor.

CHILDREN'S BUREAU

The act establishing the bureau provides that it shall investigate and report upon all matters pertaining to the welfare of children and child life among all classes of our people, and shall especially investigate the questions of infant mortality, the birth rate, orphanage, juvenile courts, desertion, dangerous occupations, accidents and diseases of children, employment, and legislation affecting children in the several States and Territories. The bureau is also empowered to publish the results of these investigations in such manner and to such extent as may be prescribed by the Secretary of Labor.

CHAPTER XV.

THE SMITHSONIAN INSTITUTION

THE SMITHSONIAN INSTITUTION, AT WASHINGTON, FOR THE INCREASE AND DIFFUSION OF KNOWLEDGE AMONG MEN

From Official Sources

THE Smithsonian Institution was created by act of Congress in 1846, under the terms of the will of James Smithson, an Englishman, who, in 1826, bequeathed his fortune to the United States of America to found, at Washington, under the name of the "Smithsonian Institution," an establishment for the "increase and diffusion of knowledge among men." From the income of the fund a building, known as the Smithsonian building, was erected on land given by the United States. The Institution is legally an establishment having as its members the President of the United States, the Vice-President, the Chief

THE SMITHSONIAN INSTITUTION, WASHINGTON, D. C.

Justice and the President's Cabinet. It is governed by a Board of Regents consisting of the Vice-President, the Chief Justice, three members of the United States Senate, three members of the House of Representatives and six citizens of the United States, appointed by joint resolution of Congress. It is under the immediate supervision of the secretary of the Smithsonian Institution, who is the executive officer and the director of all of the Institution's activities.

For the increase of knowledge the Institution aids investigators by making grants for research and exploration, supplying books, apparatus, laboratory accommodations, etc. It occasionally provides for lectures, which are published. It has initiated numerous scientific projects of national importance, some of which have resulted in the creation of independent Government bureaus. It advises the Government in many matters of scientific character, especially in those that have an international aspect.

For the diffusion of knowledge the Institution issues three regular series of publications: Annual Reports, Smithsonian Contributions to Knowledge and the Smithsonian Miscellaneous Collections. All these publications are distributed gratuitously to important libraries throughout the world.

The Institution, in co-operation with the Library of Congress, maintains a scientific library which numbers 260,000 volumes, consisting mainly of the transactions of learned societies and scientific periodicals.

The parent institution has the administrative charge of several branches which grew out of its early activities and which are supported by Congressional appropriations. These are the National Museum, including the National Gallery of Art; the International Exchange Service; the Bureau of American Ethnology; the National Zoological Park; the Astrophysical Observatory, and the Regional Bureau for the International Catalogue of Scientific Literature.

NATURAL HISTORY BUILDING, U. S. NATIONAL MUSEUM

THE UNITED STATES NATIONAL MUSEUM

Established by the act of Congress of 1846 founding the Smithsonian Institution, and under its direction, the United States National Museum is the designated depository for the national collections in art and natural history, being also charged with their classified arrangement and their use in advancing knowledge and promoting education. Starting with accommodations in the Smith-

sonian building, which it still largely occupies, two extensive structures have since been erected especially for its purposes, one completed in 1881, the other in 1911. Located on the Mall, between Ninth and Twelfth Streets, these three buildings furnish the museum with about 650,000 square feet or nearly 15 acres of floor space, somewhat more than half of which is devoted to the public exhibitions.

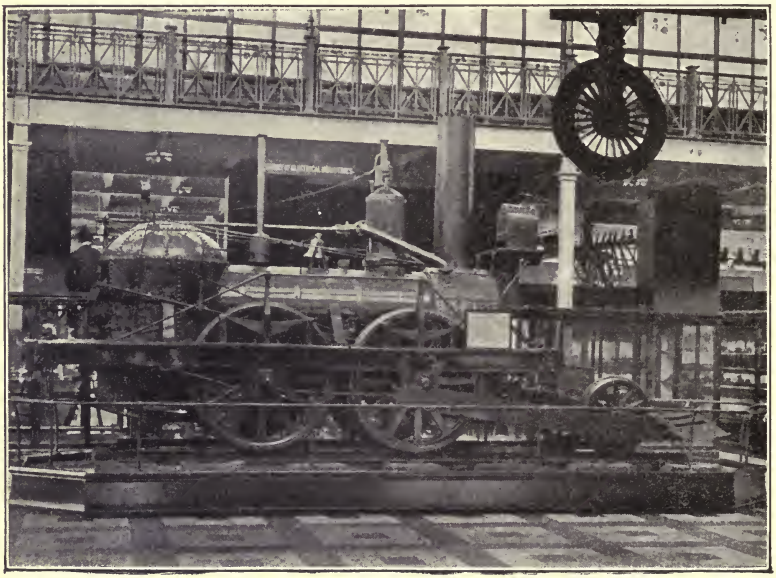
HALL OF AMERICAN HISTORY, OLDER BUILDING, U. S. NATIONAL MUSEUM

The latest building, four stories high, of white granite, with a main frontage of 561 feet and a depth of 364½ feet, and costing $3,500,000, is architecturally one of the most prominent among the Government edifices in Washington. Specifically designed to meet the requirements of natural history, and with its two main floors and part of another composed of large exhibition halls, it also contains exceptionally extensive and well-appointed laboratories and storage quarters and an auditorium.

The natural history collections, including, besides zoology and botany, geology, paleontology, ethnology, archeology and physical anthropology, represent the greatest and most important growth of the museum. The first notable acquisition consisted of the rich and varied results of the cruise of the U. S. Exploring Expedition in the South Seas and other waters during the four years from 1838 to 1842. Then, for a long period, the bulk of the accessions came from numerous special explorations, principally by the Government, in the western part of the United States, and to some extent in other near and far regions; and these were followed by the regularly organized Government surveys and investigations, still in progress. Through thousands of other sources material from every quarter of the

globe has also been acquired, and this constant flow of specimens has advanced the National Museum in its natural history departments to the highest rank among the museums of the world. Its collections are, naturally, most complete for North America, and, besides having served as the basis for extended and important researches for over two thirds of a century, they have been liberally utilized in the interest of general education, with methods of public installation developed to a remarkable stage of perfection.

of periods, the most conspicuous feature being a large and varied series of Washington relics. One hall is devoted to costumes and another to coins, medals and postal tokens. The industrial art collections are of great importance both historically and suggestively, and while inadequate facilities have somewhat retarded their development, they already form the basis of a department of the utmost practical significance. Among the subjects even now widely represented are the graphic arts and ceramics; textiles,



"JOHN BULL" ENGINE, AND HALL OF MECHANICAL TECHNOLOGY, OLDER BUILDING, U. S. NATIONAL MUSEUM

The older museum and Smithsonian buildings are assigned to American history and the industrial arts, except that the upper main story of the latter structure is occupied by the division of plants, or National Herbarium. The exhibition collections of history, which fill four halls, are especially rich in mementoes of prominent persons and

laces, embroideries, woods, medicines, foods and the various miscellaneous uses to which animal and vegetable products are put; the processes of mining and of dealing with mineral products; land, water and air transportation; fire arms and other weapons, weights and measures; electrical and other inventions, including the telegraph, tele-

phone and phonograph; and all classes of machinery and of physical apparatus.

The National Gallery of Art or department of the fine arts acquired in 1849 a notable series of engravings of the old masters and many works on art which had been assembled by George P. Marsh. Occasional additions were received in subsequent years, but it was not until the bequest of Harriet Lane Johnston in 1906 that the gallery took form. This collection of seventeen paintings, besides other objects, includes a Luini and several excellent English and Dutch portraits. In the same year Mr. Charles L. Freer, of Detroit, Mich., presented his notable collection of American and Oriental art, to which he has constantly added until its size has been more than doubled. It now consists of some 5,346 articles, of which over 1,000 are paintings, pastels, drawings, engravings, lithographs, etc., by nine American artists, headed by Whistler; while the Oriental objects, exceeding 4,300 in number, some of which date back several centuries B. C., include paintings, pottery, bronzes, sculptures, jades, glass, etc., mainly from China, Japan, Corea, Persia, India, Mesopotamia and Egypt, constituting a collection of exceptional value, unrivaled in the importance of the material it furnishes for research into the art of the Far East. To Mr. William T. Evans, of New York, the gallery is indebted for a selection of 151 paintings in illustration of the work of contemporary American artists, 106 of whom are represented, and also for numerous examples of the best American wood engraving. There have also been many individual contributions to the gallery, and, in default of other accommodations, its possessions are provisionally installed in the natural history building, except the Freer collection, for which a special building has been designed and will immediately be erected at the expense of Mr. Freer.

THE INTERNATIONAL EXCHANGE SERVICE

The International Exchange Service—a branch of the United States Government carried on under the direction of the Smithsonian Institution—serves as an intermediary for the exchange of scientific and literary publications between establishments and individuals in the United States and those in foreign countries. This phase of its work was begun soon after the Institution was founded in 1846.

Later, in 1867, an exchange of official documents between governments was established, and Congress, by act of March 2 of that year, provided for this purpose a certain number of copies of all parliamentary acts and of all publications printed by order of any department or bureau of the Government, which are forwarded through the Exchange Service to various foreign countries.

BUREAU OF AMERICAN ETHNOLOGY

The Bureau of American Ethnology was established by Congress in 1879, at the instance of the late Major J. W. Powell, for the purpose of conducting ethnologic researches among the American Indians, but subsequently its investigations were extended to include Hawaii. Although devoted chiefly to the aborigines in the United States, researches by the bureau have been conducted in lesser degree in Canada, Mexico, Central America, South America and the West Indies. In these investigations ethnology has been taken in its broadest sense to include all the activities of the Indian race, as well as their archeology and history. The results of the bureau's

studies to the present time are embodied in thirty-three annual reports and sixty-three bulletins published or in press, as well as a number of miscellaneous publications. The bureau maintains a corps of nine ethnologists, possesses an ethnologic reference library of about 21,500 volumes and 13,500 pamphlets, many thousand photographic negatives of Indian portraits and other subjects, and a large collection of original manuscripts, pertaining chiefly to Indian linguistics.

ANIMALS AT THE NATIONAL ZOOLOGICAL PARK

NATIONAL ZOOLOGICAL PARK

The National Zoological Park, established by act of Congress in 1890, "for the instruction and recreation of the people," and placed under the direction of the Smithsonian Institution, maintains a collection of living animals which is exhibited free to the public. The park occupies 169 acres in the valley of Rock Creek, about three miles northwest of the White House. The collection comprises (June 30, 1916) about 1,400 specimens. The number of visitors during 1915 was over 1,000,000. The park co-operates with the United States National Museum, the Department of Agriculture, the United States Hygienic Laboratory, and private investigators, in various ways.

THE ASTROPHYSICAL OBSERVATORY

The Astrophysical Observatory of the Smithsonian Institution, founded in 1890 and supported by small annual appropriations by Congress, is engaged in exact measurements of the intensity of the sun's radiation. Principal results: Map of Fraunhofer lines of infra-red solar spectrum to wave-length 53000 Angströms. Determination of the mean intensity of solar radiation outside the earth's atmosphere, 1.93 calories per square centimeter per minute. Discovery of the variability of the sun's radiation through a range of about 5 per cent attending the sun spot cycle, and also of an irregular variability, sometimes reaching 10 per cent in short intervals of a few days or weeks. Principal observing station on Mount Wilson, California. Expeditions to North Carolina, Sumatra, Flint Island for total solar eclipse work, and to Mount Whitney, Cal. (14,500 feet) and Bassour, Algeria, for solar

radiation work. Inventions of silver disk pyrheliometer, standard water pyrheliometers and pyranometer. Furnished about thirty standardized silver disk pyrheliometers to government and private observatories in various parts of the world.

UNITED STATES REGIONAL BUREAU — INTERNATIONAL CATALOGUE OF SCIENTIFIC LITERATURE

The International Catalogue of Scientific Literature publishes an annual classified index to the literature of science. The organization consists of a central bureau in London and thirty-three regional bureaus established in, and supported by, the principal countries of the world. That for the United States is supported by an annual appropriation from Congress, administered by the Smithsonian Institution.

TOWER TELESCOPE, ASTROPHYSICAL OBSERVATORY, MOUNT WILSON

CHAPTER XVI.

MISCELLANEOUS ACTIVITIES OF THE GOVERNMENT

THE UNITED STATES GOVERNMENT PRINTING OFFICE

WASHINGTON, D. C.

By Hon. CORNELIUS FORD, Public Printer

FROM 1789 to 1861 the Government printing and binding was done in private offices. This plan became expensive and unsatisfactory, and in 1861 Congress authorized the purchase of the printing plant then owned by Cornelius Wendall, located on a portion of the site now occupied by what is known as the "old building." This office at the time of purchase employed 300 persons, and the Government paid approximately $135,000 for the building and equipment. Subsequently various additions were made to the plant, but were inadequate to meet the demands for work. The development of printing and binding for the public is typical of the industrial and commercial growth of the republic, and emphasizes the spirit of inquiry and investigation that characterizes the American people—a spirit that is causing an almost fabulous volume of printing on subjects of general, special, or peculiar interest to our citizens.

In 1899, the need of larger quarters having become imperative, Congress authorized the construction of the present building on ground adjoining the old offices. This building is of magnificent proportions, and is a landmark in the Capital City, and an enduring monument to the art of typography and the part it plays in our Government. It contains 7 floors, with basement and loft, with floor space of 372,350 square feet, and cost approximately $2,410,000. The old building is used principally for storage, and combined floor area of entire plant is 13½ acres. The office is as nearly fireproof as any building can be made, and numerous wide staircases are distributed in such a way as to facilitate the egress of employees in case of fire or panic. The most up-to-date sanitary conditions prevail, an emergency hospital is provided for the use of employees, and a "rest room" is available for use of women employees who may become exhausted during working hours. There are about 4,000 persons employed, and the entire plant is under the direct management of the Public Printer, who is appointed by the President at an annual salary of $5,500.

The general layout is as follows: Job Composing Room—92 employees, with up-to-date equipment; this section handles 30,000 jobs in a year. Linotype Composing Section—245 employees, with 81 linotype machines and first class equipment; about 1

billion ems of type are set in one year on the linotype machines. Monotype Composing Section—435 employees, with 165 keyboards and 126 casters; about 1 billion 300 million ems of type are set in one year on the monotype machines. Hand Composing Section—225 employees, engaged principally in correcting, making up and imposing. Proof Room—270 employees, engaged in editing, preparing, reading and revising. Electrotype and Stereotype Foundry—130 employees, with up-to-date equipment, producing over 13,000,000 square inches of plated matter in a year. Press Room—443 employees, with 145 modern presses; all rollers and about one-third of necessary ink are made on premises. Bindery—950 employees, with complete machine equipment for all kinds of pamphlet and bound work. A number of smaller divisions handle special work, such as postal cards, money order books, etc. Branch offices are located in the State, War and Navy building and in the Congressional Library, and handle emergency work for these branches of the Government.

The buildings contain 16 elevators, besides several lifts for handling forms of type from pressroom or foundry. Eight automobile trucks, with capacity ranging from 1,000 to 8,000 pounds each, together with a number of side-car motorcycles, deliver all work produced in the Government Printing Office. Pneumatic tubes furnish rapid communication between various divisions. A plate vault for the storage and safekeeping of electrotype and stereotype plates is located in the basement of the new building, occupying 10,000 square feet of floor space; old plates are constantly being destroyed and the metal used over, and new plates added; about 1,200,000 plates, weighing approximately 7,000,000 pounds, are constantly on hand.

The engine room equipment consists of four electric generators totaling 2,500 kilowatts, two air compressors with capacity of 3,000 cubic feet of free air per minute, one 2,000,000 gallon pumping engine, and one refrigerating plant for circulating drinking water and making ice. The boiler room equipment consists of eight boilers, six of which are Scotch marine type, hand fired, totaling 1,800 horse-power, and two are water tube boilers with automatic stokers, totaling 1,000 horse-power; a total of 2,800 horse-power.

The total value of all machine equipment is approximately $2,500,000. The upkeep of building and equipment is under the direction of a superintendent of buildings, and this work is handled by an electrical division with 71 employees, a machinists' division with 32 employees, a carpenter division with 27 employees and a building division with 36 employees.

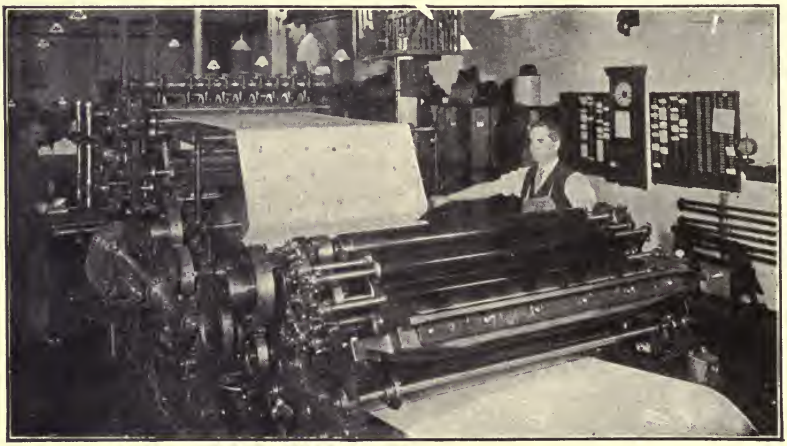
The materials used yearly are as follows: Paper stock, 32,000,000 pounds; ink, 65,000 pounds; leather stock, 300,000 square feet; gold and aluminium, 30,000,000 square inches; sewing thread, 32,000,000 yards; cloth for binding, 250,000 yards; wire for stitching, 6,500,000 feet; glue, 225,000 pounds; paste, 34,000 gallons; card containers, 3,000,000; metals, 200,000 pounds; keyboard paper, 10,200,000 feet; coal, 12,500 tons; soap, 40,000 pounds.

The Government Printing Office is the largest office in the world, but printing and binding is increasing so rapidly that it is only by extensive systematizing of production methods can Government needs be met. The vast increase in work is shown by fact that blanks, schedules, postal cards, money order forms, envelopes and similar work printed in fiscal year 1915 totaled about 3 billion copies, as compared with about 131 millions in 1880. Book work increased proportionately and about 1,700,000 type pages are set in one year.

The output of postal cards is approximately 4,000,000 a day. About 120,000,000 money order forms are printed each year and delivered in books of from 50 to 200 each.

Some of the principal items of production in a year are: Copies on job work, postal cards and money orders, 3,000,000,000; blank books, 1,130,000; newspapers and miscellaneous documents bound, 100,000; pamphlets and books printed, 100,000,000. In addition, the *Daily Congressional Record* is printed each night during session of Congress, varying in size from 8 to 225 quarto pages; the copy comes in late at night—some of it as late as 2 A. M.; type must be set, plates made, 34,000 copies printed, folded, gathered, wire-stitched and addressed in time to catch early morning mail. About 30 million copies of speeches are printed annually for Members of Congress and paid for by them. Approximately 25,000 bills and resolutions of Congress are printed during a session, varying in size from 2 to 200 pages, with from 200 to 800 copies on each. During the closing hours of a session of Congress the pressure for hurried work is tremendous and there have been times when bills making from 1 to 12 pages have been put in type, read, 1 copy printed on parchment and 3 on paper, and delivery made to the Capitol, one half mile distant, in from 15 to 20 minutes after copy is received. The bound *Congressional Record*, covering proceedings of the 63d Congress, 2d Session, made 19 volumes; 6,130 copies were printed and bound on each volume, making a total of 116,470 volumes.

The total annual expense of the office is about $6,500,000, and this amount is divided and allotted between Congress, the departments and the various bureaus of the Government, in accordance with their necessity for printing, each being allowed printing and binding only to the amount of their allotment. Existing law requires this printing and binding to be done at cost, and charges are based upon a fixed scale of prices, regulated by a modern cost system, and rendered for each piece of work produced. Employees work eight hours a day, receive a compensation comparing favorably with union wages paid throughout the country, and are allowed thirty days' vacation with pay each year. Some divisions of the office run night forces throughout the year and



PRINTING 4,000,000 POSTAL CARDS EACH DAY.

others only during the session of Congress. Employees working at night receive a 20 per cent advance over day rates in pay.

The Division of Public Documents is a central distributing agency for Government publications and receives, by law, copies of all public documents printed in the Government Printing Office. A specified number of these documents are distributed to certain designated depository libraries throughout the country, and other copies are sold at cost to the public, no more than one copy to any one person. Forty million documents are sent out by this division in a year, and in order to facilitate mailing a 30-inch belt conveyor, operating through a tunnel 7 feet high, 8 feet wide and 455 feet long, connects the Government Printing Office with the mailing tables of the city post office. Copies of Government publications can be secured by writing the Superintendent of Documents, Government Printing Office, Washington, D. C.

COUNCIL OF NATIONAL DEFENSE

The Council of National Defense was created by the act of June 3, 1916. Its membership consists of the Secretaries of War, Navy, Interior, Agriculture, Commerce and Labor, and a civilian advisory commission of seven members nominated by the Council and appointed by the President. The Advisory Commission is composed of Daniel Willard, president of the Baltimore & Ohio Railroad, chairman; Samuel Gompers, president of the American Federation of Labor; Dr. Franklin H. Martin, of Chicago; Howard E. Coffin, of Detroit; Bernard Baruch, of New York; Dr. Hollis Goudfrey, of Philadelphia, and Julius Rosenwald, of Chicago. All the members, as such, serve without compensation, but are allowed actual expenses of travel and subsistence when attending meetings of the Council, or engaged in investigations pertaining to its activities.

The duties of the Council are to supervise and direct investigations and make recommendations to the President and the heads of executive departments as to the location of railroads, with reference to the frontiers of the United States, so as to render possible expeditious concentration of troops and supplies to points of defense; the co-ordination of military, industrial, and commercial purposes in the location of extensive highways and branch lines of railroads; the utilization of waterways; the mobilization of military and naval resources for defense; the increase of domestic production of articles and materials essential to the support of armies and of the people during the interruption of foreign commerce; the development of seagoing transportation; data as to amounts, location, method and means of production, and availability of military supplies; the giving of information to producers and manufacturers as to the class of supplies needed by military and other services of the Government, and the creation of relations which will render possible in time of need the immediate concentration and utilization of the resources of the nation.

It establishes the policy for the Government departments as regards national defense. The actual work will be done by sub-committee. Its first meeting was held Dec. 6, 1916.

INTERSTATE COMMERCE COMMISSION

The Interstate Commerce Commission, appointed under "an act to regulate commerce," approved February 4, 1887, has supervision over all common carriers engaged in the transportation of passengers or property wholly by railroad, or partly by railroad and partly by

water, when both are used under common control, management, or arrangement for a continuous carriage or shipment, including express, sleeping and parlor car companies, telephone, cable, telegraph and wireless companies, and all pipe lines, from one State, Territory, or District of the United States to any other State, Territory, or District of the United States, or to any foreign country. It has jurisdiction to inquire into and report on the reasonableness of rates; undue or unreasonable preferences or advantages in transportation rates or facilities; to prescribe the publicity to be given to joint tariffs; the power to call for reports, to require the attendance of witnesses and the production of books and papers, to hear complaints of the violation of the act made against any carrier, and to determine what reparation shall be made to the party wronged.

By the act of June 18, 1910, the jurisdiction of the commission was increased as to through rates, and joint rates, freight classification, switch connections, long and short hauls, filing or rejection of freight schedules, investigations on own motion, determining reasonable rates, suspension of proposed rates, and other matters.

The act of March 2, 1893, known as the "safety appliance act," provides that railroad cars used in interstate commerce must be equipped with automatic couplers, and drawbars of a standard height for freight cars, and have grab-irons or handholds in the ends and sides of each car; and that locomotive engines shall be equipped with a power driving-wheel brake and appliances for operating the train-brake system.

Other acts have delegated further powers and duties to the commission, such as regulating the safe transportation of explosives by common carriers; compelling railroad companies to equip locomotives and tenders with safe appurtenances; the investigation of railroad accidents; compelling railroads to equip cars with sill steps, hand brakes, ladders, running boards, and roof handholds, and designating the number, dimensions, location and manner of application of appliances; and making common carriers liable for all damage to property caused by them, and forbids, with certain exceptions, limitations of liability. The commission has been directed to investigate, ascertain, and report the value of property owned or used by every common carrier.

The commission is now composed of seven members. It appoints a secretary, and such attorneys, examiners, special agents, and clerks as are necessary in the proper performance of its duties.

CIVIL SERVICE COMMISSION

The purpose of the civil service act, as declared in its title, is "to regulate and improve the civil service of the United States." It provides for the appointment of three commissioners, not more than two of whom shall be adherents of the same political party, and makes it the duty of the commission to aid the President, as he may request, in preparing suitable rules for carrying the act into effect. The act requires that the rules shall provide, among other things, for open competitive examinations for testing the fitness of applicants for the classified service, the making of appointments from among those passing with highest grades, an apportionment of appointments in the departments at Washington among the States and Territories, a period of probation before absolute appointment, and the prohibition of the use of official authority to coerce the political action of any person or body. The act also provides for investigations touching the enforcement of the rules, and forbids, under penalty of fine or imprisonment, or

both, the solicitation by any person in the service of the United States of contributions to be used for political purposes from persons in such service, or the collection of such political contributions by any other person in a Government building.

FEDERAL RESERVE BOARD

Generally speaking, the functions of the Federal Reserve Board are to exercise a broad supervision over the affairs and conduct of twelve Federal reserve banks established in accordance with the terms of the Federal reserve act in different parts of the country and invested with authority to discount paper, issue Federal reserve notes, and perform the various banking functions described in the act itself. The board has full power to appoint its own staff of employees and officers and to regulate the conditions of their employment. Its support is derived from the several reserve banks from assessments levied by it half yearly *pro rata*. The board is responsible to Congress and reports annually to that body. Certain functions in connection with the national banking system are also assigned to it under the legislation, although the Comptroller of the Currency, who is a member of the board, exercises the same general administrative and supervisory authority over the national banks that has been in his hands in the past.

THE FEDERAL TRADE COMMISSION

The Federal Trade Commission was organized March 16, 1915. It consists of five Commissioners, appointed by the President. Their term of office is seven years, and not more than three of them shall be of the same political party. The work of the Commission falls within three main divisions.

First, it is charged with the duty of enforcing the law against unfair methods of competition. It receives informal complaints of such methods employed in interstate commerce. If upon examination there is, in the judgment of the Commission, reason to believe that such unfair methods are being used it proceeds to have them corrected, either by informal negotiations with the parties complained against or, in case this fails, by filing its own formal complaint and conducting hearings in the case. If the practices complained of are found actually to exist the Commission issues its order directing those indulging in them to cease and desist. The Commission has considered and disposed of many cases and in most instances the practices complained of have been abandoned without the filing of formal complaints.

Second, it makes, either on its own initiative, if deemed in the public interest, or by direction of either House of Congress, special investigations of particular industries for the purpose of ascertaining all the facts relative thereto, with the view of correcting abuses if any are found to exist. It has concluded, or is now conducting, investigations of this kind with respect to the fertilizer, petroleum, beet sugar, coal and print paper industries, and others. It has also investigated conditions in the foreign trade of the United States and the tariff laws and regulations of several South American countries.

Third, it offers its advice and assistance to business men along lines that will be helpful in bringing about greater efficiency. In this connection it has prepared systems of cost accounting that are adapted to the needs of manufacturers and merchants. In addition to this its expert accountants are available to associations of business men for the purpose of conferring with them and

offering advice with respect to their accounting methods. Merchants and manufacturers can obtain copies of bulletins containing the accounting systems upon application to the Commission at Washington, D. C.

UNITED STATES GEOGRAPHIC BOARD

By Executive order of August 10, 1906, the official title of the United States Board on Geographic Names was changed to United States Geographic Board and its duties enlarged.

The Board passes on all unsettled questions concerning geographic names which arise in the departments, as well as determining, changing and fixing place names within the United States and its insular possessions, and all names hereafter suggested by any officer of the Government shall be referred to the board before publication. The decisions of the board are to be accepted by all departments of the Government as standard authority.

Advisory powers were granted the board concerning the preparation of maps compiled, or to be compiled, in the various offices and bureaus of the Government, with a special view to the avoidance of unnecessary duplications of work; and for the unification and improvement of the scales of maps, of the symbols and conventions used upon them, and of the methods of representing relief. All projects of importance are now submitted to this board for advice before being undertaken.

COMMISSION OF FINE ARTS

The duties of the Commission of Fine Arts consist of giving general advice upon the location of statues, fountains and monuments in the public squares, streets and parks in the District of Columbia; upon the selection of models for statues, fountains and monuments erected under the authority of the United States; and the method of selection of the artists for their execution; upon the plans and designs for public structures and parks in the District of Columbia; and upon all questions involving matters of art with which the Federal Government is concerned. The commission advises upon general questions of art whenever requested to do so by the President or a committee of Congress.

ARLINGTON MEMORIAL AMPHITHEATER COMMISSION

Created by public buildings act of March 4, 1913, to direct the construction of a memorial amphitheater and chapel in Arlington National Cemetery, Virginia, at a cost of $750,000. The building will consist of an elliptical structure inclosing an open-air amphitheater with seating capacity for about 5,000 persons. The exterior of the building will be in the form of a colonnade of white Vermont marble with entrances at the ends of the principal axes. The front entrance will be on the east, and this section will contain on the first floor a reception hall and stage of the auditorium, a museum room on the second floor and a chapel in the basement. The entrance will be on the west side.

The Commission consists of the Secretary of War, chairman; the Secretary of the Navy, the superintendent of the United States Capitol Building and Grounds and representatives of the Grand Army of the Republic, Confederate Veterans and United Spanish War Veterans. Colonel Wm. W. Harts, U. S. Army, is the Executive and Disbursing Officer of the Commission.

ALASKAN ENGINEERING COMMISSION

The Alaskan Engineering Commission was created under the act of March 12, 1914, which empowered, authorized, and directed the President to locate, construct, operate, or lease a railroad, or railroads, to connect the interior of Alaska with one or more of the open navigable ports on the coast. Authority was also granted to purchase existing railroads, to construct, maintain, and operate telegraph and telephone lines, and to make reservations of public lands in Alaska necessary for the purposes of the railroad.

For the execution of this work a commission of three engineers was appointed by the President to make the necessary surveys. They were directed to report to the Secretary of the Interior, under whom the President has placed the general administration of the work.

NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS

The National Advisory Committee for Aeronautics was appointed by the President, pursuant to act of Congress approved March 3, 1915. Its membership consists of two officers of the Army, two officers of the Navy, a representative each of the Smithsonian Institution, the United States Weather Bureau, and the United States Bureau of Standards, together with one member from the Treasury Department and four professors from various universities who are acquainted with the needs of aeronautical science, or skilled in aeronautical engineering or its allied sciences. All the members, as such, serve without compensation.

The duties of the committee, as provided by Congress, are to supervise and direct the scientific study of the problems of flight, with a view to their practical solution, and to determine the problems which should be experimentally attacked, and to discuss their solution and their application to practical questions.

UNITED STATES BOARD OF MEDIATION AND CONCILIATION

The purpose for which the Board of Mediation and Conciliation was established is to settle by mediation, conciliation, and arbitration controversies concerning wages, hours of labor, or conditions of employment that may arise between common carriers engaged in interstate transportation and their employees engaged in train operation or train service. The board is an independent office, not connected with any department.

GENERAL SUPPLY COMMITTEE

It is the duty of the General Supply Committee to make an annual schedule of required miscellaneous supplies for the use of each of the executive departments and other Government establishments in Washington, to standardize such supplies, eliminating all unnecessary grades and varieties, and to solicit bids based upon formulas and specifications. It is composed of one officer from each of the executive departments, designated by the head thereof.

BOARD OF INDIAN COMMISSIONERS

The Board of Indian Commissioners, created in 1869, is a body of unpaid citizens, appointed by the President, who maintain an office in Washington, for the expenses of which and of travel Congress appropriates. The board is not a bureau or division of any department, but is purposely kept reasonably independent and afforded opportunities for investigation in order that it may freely express an intelligent and impartial opinion concerning Indian legislation and administration. Its legal duties are to visit and inspect branches of the Indian Service, to co-operate with the Commissioner of Indian Affairs in the purchase and inspection of Indian supplies, and to report to the Secretary of the Interior, to whom and to the President the board acts in an advisory capacity, with respect to plans for civilizing or dealing with the Indians.

THE INTERNATIONAL JOINT COMMISSION

The International Joint Commission was created by treaty with Great Britain, and has jurisdiction over all cases involving the use or obstruction or diversion of waters forming the international boundary or crossing the boundary between the United States and Canada, and questions or matters of difference involving the rights, obligations, or interests of the United States or of the Dominion of Canada.

COMMISSION FOR EQUITABLE DISTRIBUTION OF WATERS OF THE RIO GRANDE

This commission was authorized by the protocol of May 6, 1896, between Mexico and the United States, and their treaty of 1848, authorizing the appointment of "commissioners" to settle "any disagreement" or "differences" between the two countries. It is commonly called "Commission for the Equitable Distribution of the Waters of the Rio Grande"—the boundary for about 1,300 miles between these two nations.

INTERNATIONAL (CANADIAN) BOUNDARY COMMISSIONS

The International (Canadian) Boundary Commissions were authorized by conventions or treaties between the United States and Great Britain, as follows:

1. January 24, 1906. For defining and marking the boundary between Alaska and British Columbia. Length, 862 miles.

2. April 21, 1906. For defining and marking the boundary between Alaska and Canada, along the 141st meridian. Length, 625 miles.

3. For defining and marking the boundary between the United States and Canada from the Atlantic Ocean to the Pacific Ocean, with the exception of the Great Lakes and the St. Lawrence River. Length, 2,647 miles.

UNITED STATES BUREAU OF EFFICIENCY

The duties of the Bureau of Efficiency are to establish and maintain a system of efficiency ratings for the executive departments in the District of Columbia; to investigate the needs of the several executive departments and independent establishments with respect to personnel, and to investigate duplication of statistical work and methods of business in the various branches of the Government service.

COURT OF CLAIMS OF THE UNITED STATES

This court was established by act of Congress February 24, 1855. It has general jurisdiction of all "claims founded upon the Constitution of the United States or any law of Congress, except for pensions, or upon any regulations of an executive department, or upon any contract, express or implied, with the Government of the United States, or for damages, liquidated or unliquidated, in cases not sounding in tort, in respect of which claims the party would be entitled to redress against the United States, either in a court of law, equity, or admiralty, if the United States were suable, except claims growing out of the late Civil War and commonly known as war claims," and certain rejected claims. The court is also vested with the jurisdiction of certain Indian depredation claims.

FEDERAL WORKMEN'S COMPENSATION COMMISSION

The Federal Workmen's Compensation Commission is charged with the administration of the Federal Workmen's Compensation Law. The law provides for the payment of 35 per cent of wages during widowhood to the widow of any workman employed by the Government and killed in the discharge of duty, and grants to a workman during period of total disability a monthly payment of two-thirds of his wages and a less amount in the case of partial disability. Provision is also made for payment to dependents, other than the widow, in case of death of a workman.

CHAPTER XVII.

THE PAN-AMERICAN UNION

AT the entrance of Potomac Park, in Washington, stands one of the most beautiful structures ever erected in the Western Hemisphere, namely, the building of the Pan-American Union. The structure and grounds represent an investment of $1,100,000, of which the American republics contributed $250,000 and Dr. Andrew Carnegie $850,000. The architecture is an appropriate combination of the classical and Spanish renaissance. A lofty vestibule opens into a typical Latin-American "patio," or courtyard, in the center of which is a beautiful fountain, while gorgeous parrots squawk around and tropical monkeys disport themselves in cages. Plants and flowers of the

PAN-AMERICAN UNION, FRONT FACADE, WASHINGTON, D. C.

rarest flora of tropical America are found everywhere, while under the cornice are the coats-of-arms of the American republics and the names of men prominent in their history. The glass roof above is operated by electricity and can be closed at a moment's notice. In the rear of the patio is a wide corridor, now used for exhibits of Latin-American countries, and back of that is a large reading and reference room.

The second floor is approached by two grand stairways and contains a broad corridor, or foyer, in which are suspended the national flags of the American republics. This foyer opens upon the "Hall of the Americas," a large salon 100 feet in length and 70 feet in width. On this floor will also be found the Governing Board room and offices. In the rear of the main structure is a beautiful sunken garden, with a pool forming the central feature, and the building of the Pan-American Annex forms the background. The tile effects are marvelous.

It may well be asked what is the meaning of this magnificent building? What is its history, organization and purpose?

The Pan-American Union (formerly known as the International Bureau of the American Republics) was established in the year 1890 in accordance with the resolutions passed at the first Pan-American conference, held at Washington in 1889-90, and presided over by Mr. Blaine, then United States Secretary of State. It was indorsed and continued by resolutions of the second conference at Mexico in 1901; the third, at Rio de Janeiro, in 1906, and the fourth, at Buenos Aires, in 1910. Its reorganization under the present administration dates practi-

PATIO, PAN-AMERICAN UNION, WASHINGTON, D. C.

cally from January, 1907, following the third conference, which was attended by Elihu Root, then Secretary of State.

The Pan-American Union is the international organization and office maintained by the twenty-one American republics, as follows: Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Cuba, Dominican Republic, Ecuador, Guatemala, Haiti, Honduras, Mexico, Nicaragua, Panama, Paraguay, Peru, Salvador, United States, Uruguay and Venezuela. It is devoted to the development and advancement of commerce, friendly intercourse and good understanding among these countries. It is supported by quotas contributed by each country, based upon the population. Its affairs are administered by a director general and assistant director, elected by and responsible to a Governing Board, which is composed of the Secretary of State of the United States and the diplomatic representatives in Washington of the other American governments. These two executive officers are assisted by a staff of international experts, statisticians, commercial specialists, editors, translators, compilers, librarians, clerks and stenographers. The Governing Board holds regular meetings to consider the work of the Pan-American Union and to act upon the reports and recommendations of the director general. This board in turn selects a supervising committee which considers matters not requiring the attention of the entire board. Appointments to the staff are made by the director general and the supervisory committee only after rigid competitive examination of applicants. Although, being an international institution, the Pan-American Union is not under the rules of the United States Civil Service, its regulations covering examinations and additions to its staff are even more strict than those of the Civil Service and usually require an accurate and fluent knowledge of Spanish or Portuguese.

Special pamphlets on the twenty Latin-American republics, with specific information as to their form of government, industries, etc., have been issued and may be obtained by addressing the Director-General, Pan-American Union, Washington, D. C.

THE "HALL OF THE AMERICAS"

INDEX

A

Accidents, Automobile 228
Accidents, Mining 195
Accidents, Railway 156, 158
Aerological Observatory 413
Aeronautics 363
Aeronautics, Military 290
Aeronautics, National Advisory Commission 589
Aeroplane, Mechanics of..... 373
Aeroplane Squadron, Rolling Stock for 375
Aeroplanes, Bombing 379
Aeroplanes, Fighting 378
Aeroplanes, Scouting 376
Agricultural Implements 216
Agricultural Population 40
Agriculture 37
Agriculture, Department of..... 547
Agriculture, Intensive 63
Aircraft, Records 378
Airships 367
Alaska 327
Alaskan Fisheries 71
Aluminium 182
"America" 353
American Commerce 231
American Flag 347
Animal Industry, Bureau of..... 555
Antarctic Regions 10
Anticyclones 416
Antimony 184
Apples 50
Architect, Supervising Treasury.... 503
Arctic Regions 10
Area of the United States..... 19
Area of United States and Foreign Countries 21
Arlington Radio Station..... 385
Army Bill 282
Army, Enlistments 284
Army, Recruiting 286
Army, Reserve 288
Army, United States..... 281
Arsenic 194
Asbestos 194
Asphalt 195
Assay Office, New York..... 309
Astronomy 423
Astrophysical Observatory 580
Attorney General 519
Atmosphere, The 411
Aurora 418
Automobile Industry 223
Aviation, Military 375

B

Balboa 4
Balloon Sounding 412
Balloons 364
Barley 44
Barytes 188
Battleships, Wireless on..... 389
Beans 56
Bell, Alexander Graham..... 208
Bicycles 217
Bill Washing Machine..... 297
Bills, Legislative 458
Biological Survey 556
Bismuth 184
Blast Furnaces 215
Blizzards 419
Bombing Aeroplanes 379
Borax 195
Box Manufacture 80
Brick 190
Bridge, Hell Gate..... 151
Bromine 194
Buckwheat 45
Buildings, Tall 210
Bullion, Melting and Refining of... 309
Butter 213
Butter Churning 60

C

Cabinet, The 476
Cables of the World..... 382
Calcium Chloride 194
Canning and Preserving..... 212
Capitol at Washington..... 455
Carriages 217
Cars, Railway 147
Cattle Raising Regions..... 59
Cattle Statistics 60
Cement 190
Census Bureau 564
Census, First 482
Cheese 213
Chemicals 220
Chemistry, Bureau of..... 556
Children's Bureau 574
Chromic Iron Ore..... 184
Cities of the United States..... 29
Civil Service Commission..... 586
Claims, Court of..... 590
Clay and Clay Products 190
Climate 422
Cloud Forms 410, 420
Coal 186
Coal Production, World's..... 183
Coast and Geodetic Survey..... 127
Coast Guard 139, 502
Cocoa, World's Production of..... 55
Cod 70
Coffee, World's Production of..... 55
Coins, Counting, by Machines..... 295
Coins, Legal Weight of..... 320
Coins, Minting of 313
Coke Oven By-Products..... 186
College Enrollment 255
Columbus, Discoveries of..... 2
Comets 437

Commerce, American 231
Commercial Preparedness 245
Comptroller of the Currency..... 494
Commissioner of Patents..... 540
Construction and Repair, Bureau of 536
Comptroller of the Treasury..... 498
Commerce, Department of..... 561
Consular Service 485
Copper 180
Copper, World's Production of..... 197
Cordage 213
Corn 42
Cotton 47, 49
Cotton Goods 213
Cotton, World's Production of..... 48
Court of Claims, U. S..... 590
Crossties 80
Crossties Purchased 82
Crosstie. Wood for 82
Culebra Cut 117
Cultivation, World's Commercial.... 39
Cusk 70
Cyclones 416

D

Daguerre 207
Dairy Production, World's..... 64
Declaration of Independence...486, 487
Defense, Council of National..... 585
Department of State..... 479
Derelicts, Destroying 142
Desertions, Navy 274
Diamonds, World's Production of.. 197
Diesel, Dr. 209
Dirigible Balloons 368
Dutch Possessions 13
Dye Plants 249
Dyestuffs 220

E

Eads, James B..... 205
Earthquakes 9
Edison, Thomas A..... 198
Education 255, 544
Eiffel Tower Wireless..... 391
Electric Cars 217
Electrical Industry 217
Ellis Island 35, 501
Education 255, 544
Engraving and Printing, Bureau of 299, 499
Enlisted Men, Navy..... 272
Enlistments, Army, ... 284
Entomology, Bureau of..... 556
Ericsson, John 205
Ethnology, Bureau of..... 579
Explosives 220
Exports and Imports.....232, 233
Express Service 154

F

Families per Square Mile..... 24
Farm Products 38, 62
Federal Reserve Act..... 248
Federal Reserve Board..... 587
Federal Trade Commission ...248, 587
Feldspar 195
Felt Goods 213
Fertilizers 220
Fighting Aeroplanes 378
Fine Arts Commission..... 588
Fire Lookout 74
Fires, Forest 86
Fish Commission Car..... 69
Fish We Eat..... 67
Fisheries, Bureau of.....72, 566
Fisheries of the World..... 66
Fisheries Products 68
Flag, Battle, of Lake Erie..... 358
Flags, Trophy, of the U. S. Navy.. 357
Flax 50
Flour and Grist Mills..... 212
Fluorspar 190
Foghorn 138
Footwear 219
Foreign Trade Problems 247
Forest Fires 84
Forest Regions, Natural 81
Forests and Forestry.....75, 555
Forests, National 84
Freight Service, Railway.....152, 154
French Possessions 13
Fuels 186
Fuller's Earth 195

G

Gaillard Cut 117
Garnet 195
Gas Industry 221
Gas, Natural 188
Gatling, R. J..... 206
Gems and Precious Stones..... 195
General Staff Corps..... 507
Geodetic Survey 127
Geographical Discovery, Progress of.1, 11
Geological Survey 119
Geographic Board, U. S..... 588
German Possessions, Former..... 13
Geysers 94
Glacier Park 98
Glass 221
Gloves, Leather 219
Glucose 222
Goethals, Colonel 118
Gold 177
Gold Production, World's..... 179
Good Roads and Bad..... 103
Government Protection at Sea..... 135
Government Surveys 119
Granite Production 196
Graphite 195
Gravel 196
Great Britain's Possessions..... 12
Greenbacks, How Made..... 299
Guam 344
Gypsum 192

H

Haddock 67
Hake 71
Hail 421
Halibut 67, 70
Halos 420
Hats 213
Hawaiian Islands 330
Hay 46
Health Service, U. S. Public..... 500
Heavens Above 423
Herring 70
Hides and Skins 64
Houses of Congress..... 455
Hops 54
Horses and Mules..... 60
Hosiery 213
House of Representatives..... 457

House of Congress 455
Howe, Elias, Jr. 202
Humidity 419
Hydrographic Office 129

I

Ice, Artificial 221
Illiteracy 257
Immigration 33, 34, 573
Imports and Exports 232
Inaugural Address, President Delivering 464
Inaugural Procession 450
Indian Population 26
Industrial Preparedness 245
Insurance, War Risk 504
Intensive Agriculture 63
Interior, Department of the 539
Internal Revenue, Commission of .. 496
Interstate Commerce Commission .. 585
Inventors, Hired 204
Iron Ore and Iron 180
Iron Ore, Chromic 184
Iron, World's Production of 183
Irrigation (See Reclamation)
Isochronic Distances of the World .. 346

J

Jupiter 436
Justice, Department of 519
Jute 213

K

Knit Goods 213
Kodak, Autographic Patent 206

L

Labor, Department of 572
Labor Statistics, Bureau of 574
Land and Sea, Profiles of 6, 7
Land Office, General 544
Languages of the World 25
Laths 77
Laundries 222
Lead 182
Lead, World's Production of 197
Leather Industry 219
Legislative Halls 455
Library of Congress 261
Libraries 260
Lighthouses, Bureau of 135, 566
Lightning 418
Lightships 138
Lime 195
Limestone Production 196
Lincoln Highway 106
Linoleum 214
Live Stock 60
Livingstone 5
Lobsters 71
Locks, Panama 110, 111, 113
Locomotive, Powdered Coal Burning 151
Locomotives 147
Lumber Cut 76
Lumber Production 77

M

Machine Guns 291
Magnesite 195
Mail Cars 160
Maine, Ensign of the 362
Males and Females, Proportion of. 30
Manganese 184
Manufactures 211
Maps, Geologic 120
Marble Production 196
Mars 436
Maxim, Sir Hiram 208
Meat Packing 61
Median Point 22
Medicine and Surgery, Bureau of .. 534
Men of Progress 201
Metallic Products, Miscellaneous ... 184
Metals, Scrap 186
Meteors 437
Mica 196
Mileage, Railway, of the U. S. 146
Military Aviation 375
Military Bureaus 511
Military Establishment 282
Militia, Peace Strength of 280, 289
Milk, Condensed 213
Milky Way 430
Mineral Industry of the U. S. 177
Mineral Paints 196
Mines, Bureau of 191, 193, 544
Mining Accidents 195
Mint, Director of the 496
Minting of Coins 313
Mirage 421
Money, Destruction of Old 292
Money in Circulation 294
Money, Uncle Sam's 293
Monuments, National 101
Moon 434, 438
Motion Pictures in the Making 399
Motorcycles 217
Moving Picture Studio, First 409
Moving Pictures Under Water 398
Mules and Horses 60
Mussel 72

N

National Museum 576
National Parks, Our 95
Nation, Heart of the 449
Natural Gas 188
Naturalization 574
Nauen Wireless Station 393
Naval Consulting Board 276
Naval Officers 276
Navigation, Bureau of 528, 567
Navy, Cost of 269
Navy, Department of the 526
Navy, Enlisted Men 272
Navy Expenditures 270
Navy, The New 263
Navy Increase Since 1903 263
Navy, Secretary of the 526
Naval Observatory 529
Navy, Vessels of 266
Nebulae 429
Negro Population 26
Newspaper Plant, Railway 157
Nickel 184
Non-Metallic Products 188
Notes Issued and Redeemed 296

O

Oats 44
Occupations 34, 35
Oilcloth 214
Oils, Vegetable, World's Production of 187

Ore Handling, Mechanical 244
Organization of Government 478
Organs 222

P

Paints and Varnishes..... 220
Paints, Mineral 196
Panama Canal 109
Panama Canal Zone 345
Pan-American Union 591
Paper 219
Parcel Post 162
Parks, National, Our 95
Passenger Service, Railway....152, 154
Patent, Early 200
Patent Office 199, 540, 541
Patents Increasing 202
Peaches 54
Peary, Admiral 8
Peas 56
Pension Office 543
Petroleum 185, 187, 188
Philippine Islands 335
Phonographs 222
Phosphate Rock 192
Pianos 222
Pipe, Cast Iron 217
Planets 433
Plant Industry 555
Platinum 178
Poles 80
Pollock 70
Ponce de Leon 3
Population of the U. S..... 19
Population of the World..... 23
Population, Center of 20, 22
Porto Rico 341
Portuguese Possessions 13
Possessions, Our Non-Contiguous... 327
Postmaster General 522
Postage Stamps, Making..... 171
Postal Savings 165
Postal Service 161
Post Office Department 522
Post Office Expenditures 168
Potash 192
Potatoes 45
Pottery Products 190
Powder, Naval 278
Power Development, Reclamation.. 91
Precious Stones, World's Production of 195, 197
Precipitation 421
Preparedness, Commercial and Industrial 245
President, Letter from the..... 172
President, The 465
Printing and Publishing..... 220
Printing Office, Government..... 582
Progress of Geographical Discovery. 11
Pulp, Wood 219
Purchases Made by U. S..... 240

Q

Quarry Industry 196
Quicksilver 184

R

Races of U. S. 24
Races of the World..... 27
Radium 184
Railroads of the U. S..... 145
Railway Mail 166
Railway Wireless 387
Realm of the Air, The..... 411
Reclamation Service 87
Records, Aircraft 378
Religions of the World..... 31
Resources, National 173
Revenue, Protection of 321
Rice 50, 212
Roads, Good and Bad..... 103
Roads, Public, Office of..... 559
Rolling Mills 215
Roosevelt Dam 93
Rosin 221
Rubber Goods 221
Rubber, World's Production of..... 48
Rural Free Delivery..... 164
Rye 45

S

Safety First Train..... 147
Salt 194
Samoan Islands 344
Sand 196
Sandstone Production 196
Saturn 432, 437
School Enrollment 255
Scouting Aeroplanes 376
Seal Fisheries 71
Seal of the U. S..... 480
Seaplanes 380
Seasons, March of the..... 414
Senate Chamber 456
Sheep 65
Sheep Raising Regions 59
Sleet 421
Shipbuilding 217
Shipping Board 248
Ship Registry Act..... 248
Ship Wireless Stations..... 389
Silk 214
Silver 178
Silver Production, World's..... 179
Skins and Hides..... 64
Sky Line, New York's..... 33
Slate 196
Slaughtering and Meat Packing... 212
Small Arms, Military..... 289
Smithsonian Institution 575
Smudge Pots 58
Smuggling 325
Soap 221
Soapstone 196
South Pole Expedition..... 10
Standards, Bureau of..... 565
Stamps 162
Stamps, Manufacture of..... 304
Starch 222
Star Maps 439, 445
Stars 427
"Star Spangled Banner"..... 351
State, Department of 479
Steamboat Inspection Service..... 569
Steam Cars 217
Steam Engineering, Bureau of..... 534
Steel Works 215
St. Elmo's Fire..... 418
Stockholders, Railway 150
Street Railways 158
Suffrage, Woman's 32
Sugar 58
Sugar, World's Production of..... 57
Sulphur 194

Sulphuric Acid 194
Supreme Court 461
Surf Boat 141
Survey, Coast and Geodetic 127
Survey, Geological 117
Survey, Hydrographic 129
Surveying, Romance of..... 125
Surveys, Government 119
Swine 65
Sword Fish 70

T

Talc 196
Talking Machines 222
Tariff Commission 248
Tea, World's Production of..... 55
Teachers 258
Telegraphic Communications of the World 382
Telegraphy, Wireless 383
Telephony Without Wires..... 392
Telescopes 425
Territory, Acquisition of..... 21
Textiles 213
Thunderstorms 417
Tide Predictor 131
Tile and Brick..... 190
Tile Fish 72
Timber Cut by Species..... 79
Timber Regions of the World..... 78
Timber Supply 75
Tin 186
Tin and Terne Plate..... 217
Tin, World's Production of..... 197
Titanium 186
Tobacco 50, 52, 53
Tobacco Culture 53
Tobacco, World's Production of.... 51
Tomato Plants 54
Tolls, Panama Canal 112
Topographic Work 122
Tornadoes 417
Track, Railway 146
Transportation 217
Treasury 293
Treasurer of the U. S. 495
Treasury, Department of the..... 493
Treasury Receipts and Disbursements 298
Tree, Oldest 95
Triangulation Survey 126
Tungsten 186
Turpentine 221
Twine 213

U

Uncle Sam's Autobiography..... 447
United States Possessions..... 13
Uranium 186

V

Vanadium 186
Vegetable Oils, World's Production of 187
Vespucci, Amerigo 3
Vocational Education 259
Volcanoes of the World..... 9

W

Wagons 217
War College, Army 508
War, Department of 506
War Game, Army 510
War, Secretary of 506
Washington Monument 451
Washington, the Nation's City..... 447
Water Power on National Forests.. 85
Weather Bureau 548
Westinghouse, George 207
Wheat 43
Whistle, Uncle Sam's 446
White House 467
Wilson, A. B..... 203
Wind Belts of the Earth..... 415
Wine, World's Production of..... 54
Wire 216
Wireless, Railway 387
Wireless Telegraphy 383
Woman's Suffrage 32
Wood Preservation 82
Woolen and Worsted Goods..... 215
Woolworth Building 254
Workmen's Compensation, Federal. 590
Wright Brothers 363

Y

Yards and Docks, Bureau of..... 531
Yosemite 100, 102

Z

Zeppelin Airships 378
Zinc 182